SAILOR®

SAILOR 900 VSAT System

Thrane & Thrane

SAILOR 900 VSAT

Installation and user manual

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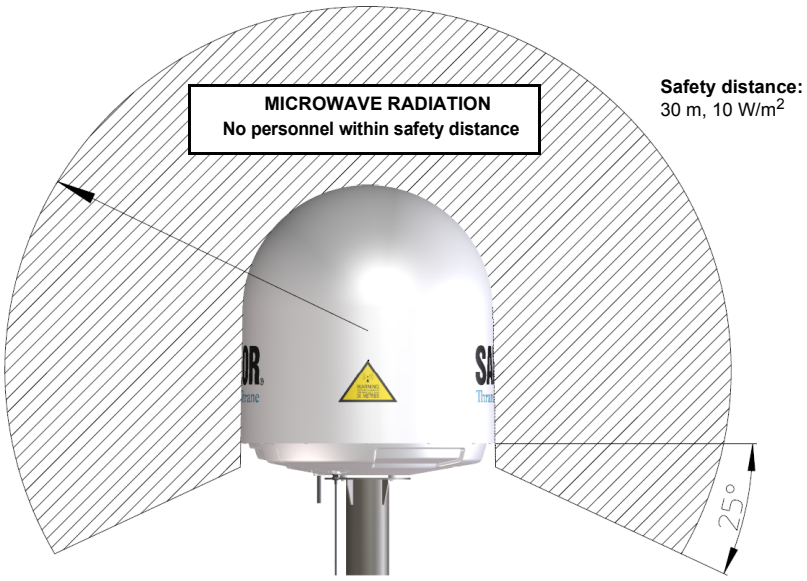
Safety summary

The following general safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the equipment. Thrane & Thrane A/S assumes no liability for the customer's failure to comply with these requirements.

Microwave radiation hazards

During transmission the Above Deck Unit (antenna) in this system radiates Microwave Power.This radiation may be hazardous to humans close to the Above Deck Unit. During transmission, make sure that nobody gets closer than the recommended minimum safety distance.

The minimum safety distance to the Above Deck Unit reflector on the focal line is 30 m, based on a radiation level of 10 W/m^2. No hazard exists >25° below the Above Deck Unit's mounting plane. Refer to the drawing below.



No-transmit zones

In order to protect personnel no-transmit zones can be programmed. For further information see *Blocking zones – azimuth and elevation* on page 3-5.

Distance to other equipment

Do not move the Above Deck Unit closer to radars than the minimum safe distance specified in section *Interference* on page 3-13 – it may cause damage to the Above Deck Unit.

Compass Safe Distance:
SAILOR 900 VSAT antenna or ADU (Above Deck Unit): min. 130 cm (IEC 945).
SAILOR 900 VSAT ACU (Antenna Control Unit): min. 10 cm (IEC 945)

Service
User access to the interior of the ACU is prohibited. Only a technician authorized by Thrane & Thrane A/S may perform service - failure to comply with this rule will void the warranty. Access to the interior of the Above Deck Unit is allowed. Replacement of certain modules and general service may only be performed by a technician authorized by Thrane & Thrane A/S.

Grounding, cables and connections
To minimize shock hazard and to protect against lightning, the equipment chassis and cabinet must be connected to an electrical ground. The ACU must be grounded to the ship. For further grounding information refer to the Installation manual.

Do not extend the cables beyond the lengths specified for the equipment. The cable between the ACU and Above Deck Unit can be extended if it complies with the specified data concerning cable losses etc.

Rx and Tx cables for the SAILOR 900 VSAT system are shielded and should not be affected by magnetic fields. However, try to avoid running cables parallel to high power and AC/RF wiring as it might cause malfunction of the equipment.

Power supply
The voltage range for the SAILOR 900 VSAT is 20 – 32 VDC. Note that the Above Deck Unit is powered by the ACU.

If a 24 VDC power bus is not available, an external 115/230 VAC to 28 VDC power supply can be used, for example a SAILOR 6080 Power Supply.

Do not operate in an explosive atmosphere
Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Keep away from live circuits
Operating personnel must not remove equipment covers. Component replacement and internal adjustment must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Failure to comply with the rules above will void the warranty!

Record of Revisions

Rev.	Description	Release Date	Initials
A	Original document	26 September 2011	UFO
B	The following sections have been added: 6.3.6, 6.3.7, 6.3.8, 9.4, Appendix B, Appendix C. The following sections have been edited: 1.2, 3.1.1, 3.2.6 (p. 3-10) 3.6.1, 4.1.7, 6.2.2, 6.3, 9.1.1. The following figures have been added: 6-3, A-1, A-2, The following figures have been edited: 2-4, 2-5, 6-4, 6-5, 6-6, 6-7, 6-14, 8-1, 9-10, 9-11. The following tables have been edited: 2-1, 2-2, 6-5.	8 November 2011	UFO

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About this manual

1.1 Intended readers

This is an installation and user manual for the SAILOR 900 VSAT system, intended for installers of the system and service personnel. Personnel installing or servicing the system must be properly trained and authorized by Thrane & Thrane. It is important that you observe all safety requirements listed in the beginning of this manual, and install the system according to the guidelines in this manual.

For daily use of the SAILOR 900 VSAT system see the SAILOR 900 VSAT Quick guide or *Daily use – Quick guide* on page 8-1.

1.2 Manual overview

This manual has the following chapters:

- *Introduction*
- *Installation*
- *Interfaces*
- *Connecting power*
- *Configuration*
- *Installation check*
- *Daily use – Quick guide*
- *Service*

This manual has the following appendices:

- *Technical specifications*
- *VMU cable specifications*
- *VMU settings requirements*
- *Grounding and RF protection*
- *System messages*

1.3 Related documents

The following related documentation is referred to in this manual:

Document number	Title
98-133401	SAILOR 900 VSAT Quick guide

Table 1-1: List of Related Documents

1.4 Typography

In this manual, typography is used as indicated below:

Bold is used for the following purposes:

- To emphasize words.
  Example: “Do **not** touch the antenna”.
- To indicate what the user should select in the user interface.
  Example: “Select **SETTINGS** > **LAN**”.

Italic is used to emphasize the paragraph title in cross-references.

Example: “For further information, see *Connecting Cables* on page...”.

1.5 Precautions

Warnings, Cautions and Notes

Text marked with “Warning”, “Caution”, “Note” or “Important” show the following type of data:

- **Warning**: A Warning is an operation or maintenance procedure that, if not obeyed, can cause injury or death.
- **Caution**: A Caution is an operation or maintenance procedure that, if not obeyed, can cause damage to the equipment.
- **Note**: A Note gives information to help the reader.
- **Important**: A text marked Important gives information that is important to the user, e.g. to make the system work properly. This text does not concern damage on equipment or personal safety.

General precautions

All personnel who operate equipment or do maintenance as specified in this manual must know and follow the safety precautions.
The warnings and cautions that follow apply to all parts of this manual.

WARNING! Before using any material, refer to the manufacturers' material safety data sheets for safety information. Some materials can be dangerous.

CAUTION! Do not use materials that are not equivalent to materials specified by Thrane & Thrane. Materials that are not equivalent can cause damage to the equipment.

CAUTION! The system contains items that are electrostatic discharge sensitive. Use approved industry precautions to keep the risk of damage to a minimum when you touch, remove or insert parts or assemblies.

Introduction

This chapter is organised in the following sections:

- *SAILOR 900 VSAT system*
- *Part numbers and options*

2.1 SAILOR 900 VSAT system

The SAILOR 900 VSAT is a unique stabilized maritime VSAT antenna system operating in the Ku-band (10.7 to 14.5 GHz). It provides bi-directional IP data connections both on regional satellite beams and quasi-global Ku-band satellite networks. The system only requires a single 50 Ohm cable to provide the Above Deck Unit with both DC power, data and control information. The radome does not have to be opened neither before nor after the installation. To protect the Above Deck Unit the built-in DC motors act as breaks during transport and when the Above Deck Unit is not powered. The ADU system can be accessed remotely and in-depth performance analysis can be done using the built-in web interface.

The SAILOR 900 VSAT system consists of two units:

- Above Deck Unit (ADU)
- Antenna Control Unit (ACU)

The following figures show the SAILOR 900 VSAT system with its two variants of ACUs.

Figure 2-1: Above Deck Unit and Antenna Control Unit (ACU)

Figure 2-2: Above Deck Unit and Antenna Control Unit (ACU), 19" rack version

SAILOR 900 VSAT features

- Single 50 Ohm coax cable for the ADU.
- Support of several VSAT modems.
- Service communication using SAILOR FleetBroadband over WAN.
- Remote or local simultaneous software update of ADU and ACU via PC and Internet browser.
- Global RF configuration.
- Full remote control and troubleshooting with built-in test equipment (BITE).
- ACU with 4 x LAN, NMEA 0183, NMEA 2000, RS-232 and RS-422.
- All interfaces at the ACU, no additional units required.
- DC powered. Start up voltage: 22 VDC guaranteed, operating range: 20 – 32 VDC.
- No scheduled maintenance.

2.1.1 Above Deck Unit (ADU)

The SAILOR 900 VSAT Above Deck Unit is a 103 cm VSAT stabilised tracking antenna, consisting of a suspended antenna with a standard global RF configuration. The Above Deck Unit's weight is around 135 kg. It is stabilized by heavy duty vibration dampers in 3-axis (plus skew) and can be used in environments with elevations of -25° to + 125°. The Above Deck Unit is powered by the Antenna Control Unit and protected by a plastic radome.

Figure 2-3: Above Deck Unit (ADU)

Modules in the SAILOR 900 VSAT Above Deck Unit

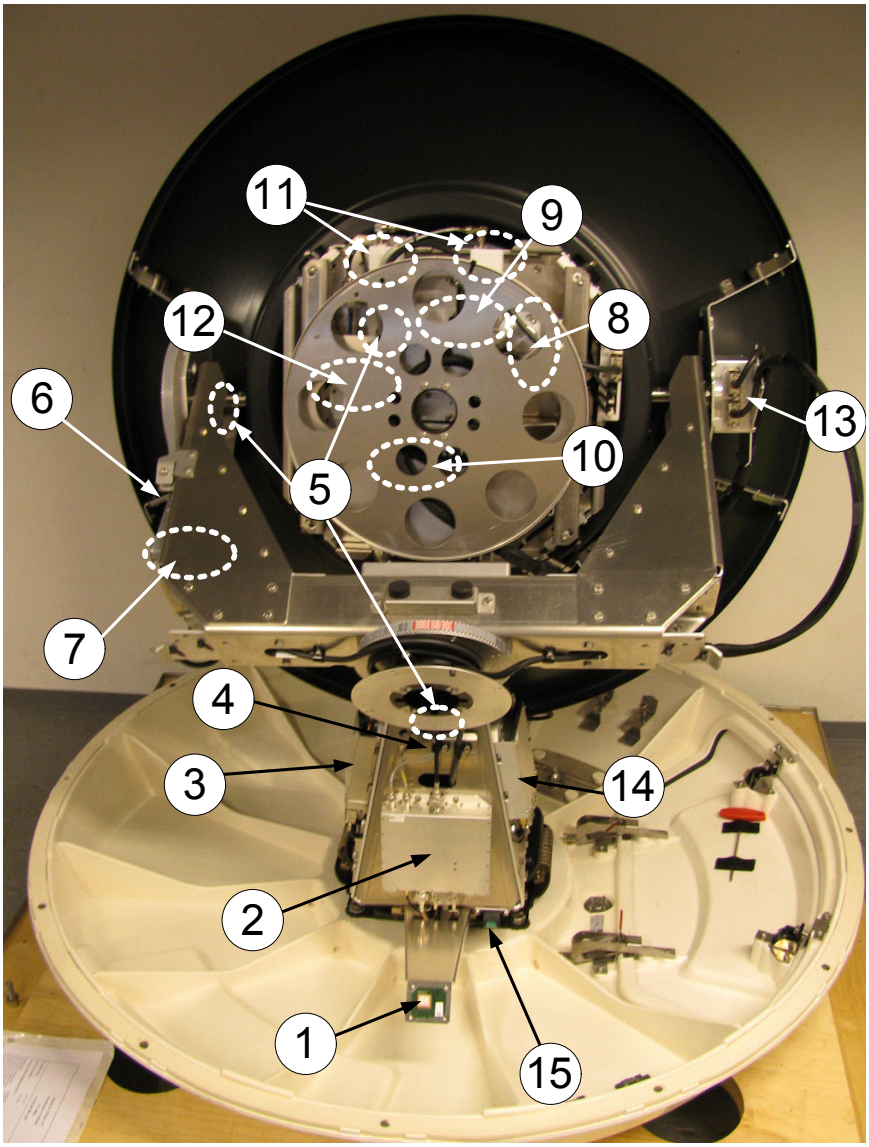


Figure 2-4: Above Deck Unit modules 1/2

1. GPS module.
2. VSAT Interface Module (VIM).
3. DC-Motor Driver Module for cross elevation (DDM).
4. Cross elevation motor and encoder.
5. Zero Reference Module (x4) (ZRM). (not visible on photo)
6. DC-Motor Driver Module for elevation (on the side).
7. Elevation motor and encoder. (on the side)
8. Polarisation Motor Module (PMM). (not visible on photo)
9. Polarisation motor and encoder. (not visible on photo)

10. Block Up Converter (BUC). (behind cable screen, not visible on photo)
11. Low Noise Block downconverter (x2) (LNB). (not visible on photo)
12. Ortho Mode Transducer (OMT). (not visible on photo)
13. Inertial Sensor Module (ISM).
14. Pedestal Control Module (PCM).
15. Service switch.
    In switch-off position the DC Motor Driver modules and the BUC are turned off for safe conditions during service and repair. The switch must be in on position for normal ADU operation.

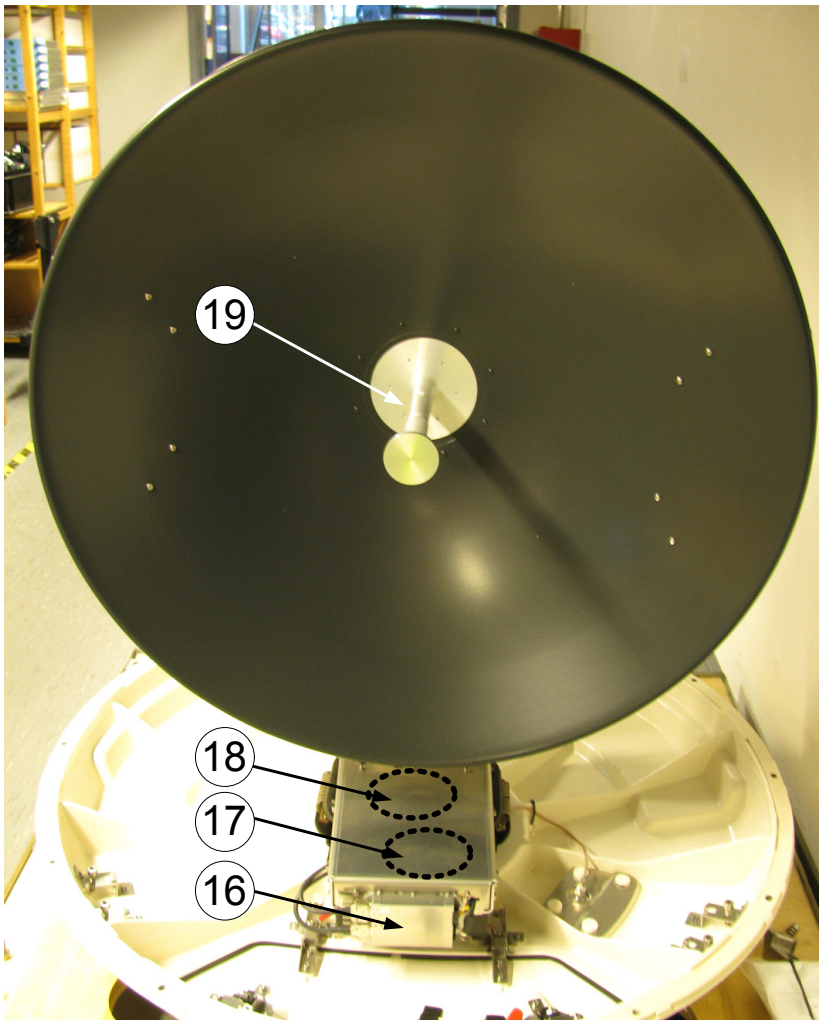


Figure 2-5: Above Deck Unit modules 2/2

16. DC-Motor Driver Module for Azimuth.
17. Azimuth motor and encoder. (not visible on photo)
18. Rotary joint. (not visible on photo)
19. Feed horn.

SAILOR 900 VSAT Above Deck Unit interface

All communication between the Above Deck Unit and the ACU passes through a single standard 50 Ohm cable (with N connector) through the rotary joint. No cable work is required inside the radome.

Installation friendly

Four lifting brackets (included in the delivery) and reuse of packing material help getting the Above Deck Unit safely into place. Satellite link parameters are entered using a PC and the built-in web server of the ACU. They can be displayed at the ACU.

The included cable relief support can be attached to the ACU.

Service friendly

The system configuration is saved in two modules, there is no loss of data at repair. The large service hatch of the radome gives easy access to the ADU on site (one-hand operation). The service switch in the ADU stops the DC Motor Driver modules, turns the BUC off and switches on the light inside the radome. The service tools for replacing modules are placed on a tool holder inside the radome.

All modules have a service and power LED status indicator. Each module is encapsulated in a metal box with self-contained mounting bolts.

If necessary, belts and modules can be exchanged through the service hatch on site.

You can do remote diagnostics and service with the ADU. Its built-in test equipment checks constantly the ADU's components for proper functioning, it monitors and logs information for all modules. The ADU performs a POST (Power On Self Test) and you can request a self test (Person Activated Self Test) and has Continuous Monitoring (CM). Error codes can be read out in the web interface and in the display of the ACU.

Software update is done using a PC connected via LAN to the ACU.

2.1.2 Antenna Control Unit (ACU)

The Antenna Control Unit, also called ACU, is the central unit in the system. It contains all user interfaces and manages all communication between the ADU and the VMU, a connected PC and an optional FleetBroadband service communication line. The ACU has a display, status LEDs and a keypad. It provides a DHCP client. During configuration you can configure heading offset, save satellite and VMU setups and enter *No Transmit Zones* (blocking zones in which the ADU does not transmit).

The ACU provides DC power to the ADU through a single coaxial cable. You can use the TT-6080A Power Supply to provide the DC power (20-32 VDC).

ACU interfaces

The ACU has the following interfaces and switch:

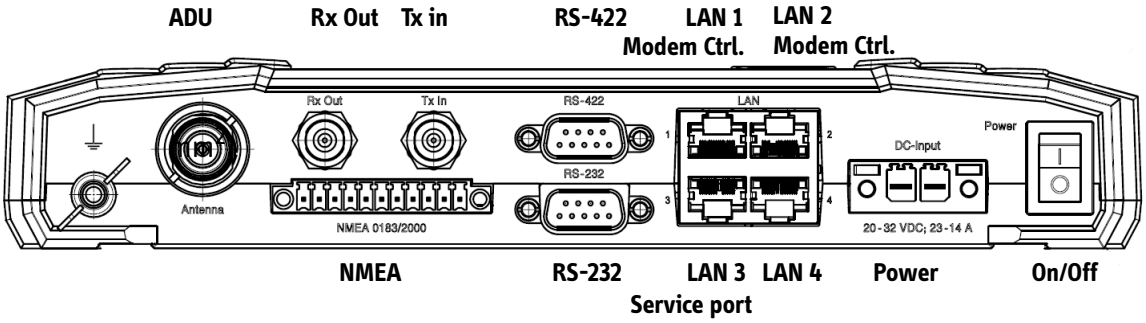


Figure 2-6: SAILOR 900 VSAT ACU, connector overview

- N-connector for ADU cable (50 Ohm).
- 2 x F-connectors for Rx and Tx cables (75 Ohm) to VSAT modem.
- Multi connector for NMEA interfaces (for input from GPS compass or Gyro compass).
- RS-422 interface for modem control.
- RS-232 interface for modem control.
- 4 x LAN ports for VSAT modem control and user equipment (i.e. for SAILOR FleetBroadband service communication line or WAN port for VSAT Internet).
- Power connector.
- On/Off power switch

The 19" rack version of the ACU has additionally a LAN connector at the front for accessing the service port from the ACU front panel.

Figure 2-7: SAILOR 900 VSAT ACU, 19" rack version

Installation friendly

The ACU comes in two models: Wall or desktop installation (bulkhead) or in a 19" rack version.

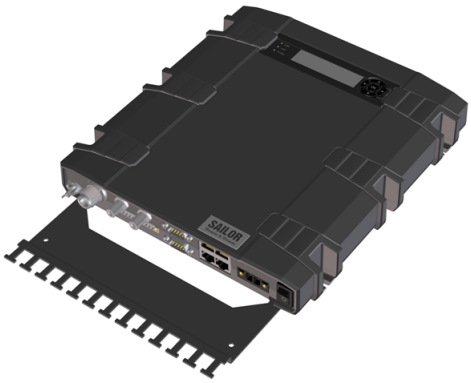


Figure 2-8: Antenna Control Unit for bulkhead installation

Figure 2-9: Antenna Control Unit for 19" rack installation

Service friendly

You can do remote diagnostics and service with the ACU. Its built-in test equipment checks constantly the ACU's modules for proper functioning, it monitors and logs for all modules. It performs POST (Power On Self Test) and you can request a PAST (Person Activated Self Test). Continuous Monitoring (CM) is another option. BITE error codes can be read out in the web interface and in the display of the ACU.

Software update is done via a connected PC and the built-in web interface of the ACU.

2.1.3 VSAT Modem Unit (VMU)

SAILOR 900 VSAT is designed to be operated with third-party VSAT modems. For a list of supported VSAT modems see the SAILOR 900 VSAT data sheet at thrane.com.

For the latest status of supported VMUs see http://extranet.thrane.com/ and click ESUPPORT.

2.1.4 Satellite type approvals

For a list of satellite type approvals see the SAILOR 900 VSAT data sheet at thrane.com.

2.1.5 Power supply

To provide DC power to the SAILOR 900 VSAT you can use the TT-6080A Power Supply.

2.1.6 Service activation

Before you can start using the SAILOR 900 VSAT, you need to activate the system for VSAT service. Contact your service provider for activation.

2.2 Part numbers and options

2.2.1 Applicable Thrane & Thrane model- and part numbers

This Installation Manual is for the SAILOR 900 VSAT system and is applicable to the model- and part numbers below:

T&T part number	Model number	Description
407009A-00500	TT-7009A-THR	SAILOR 900 VSAT Above Deck Unit (ADU)
407016A-00500	TT-7016A-T19	SAILOR 900 VSAT Antenna Control Unit (19 inch rack)
407016A-00510	TT-7016A-TBH	SAILOR 900 VSAT Antenna Control Unit (bulkhead)

Table 2-1: Model and part numbers for the SAILOR 900 VSAT system (T&T units)

2.2.2 Options for SAILOR 900 VSAT

The following options are available for the SAILOR 900 VSAT system:

T&T part number	Model number	Description
406080A	TT-6080A	Power Supply
407090A-950		Antenna cable 50 m, N-Conn (not mounted), male/male
407090A-925		Pigtail Cable 1.25 m, N-Conn, female/male

Table 2-2: Model and part numbers for options of the SAILOR 900 VSAT system

For information on accessories available for the SAILOR 900 VSAT see http://extranet.thrane.com/ and click ESHOP.

Installation

This chapter is organised in the following sections:

- *Unpacking*
- *Site preparation*
- *Installation of the ADU*
- *Installation of the ACU (bulkhead)*
- *Installation of the 19" rack version of the ACU*
- *Installation of the VMU*

3.1 Unpacking

3.1.1 What's in the box

ADU

Unpack your SAILOR 900 VSAT ADU and check that the following items are present:

- ADU with 4 lifting brackets (already mounted)
- Package with bolts and washers

ACU (bulkhead)

Unpack your SAILOR 900 VSAT ACU (bulkhead) and check that the following items are present:

- 1 x Ethernet cable (2 m)
- Power connector
- 2 x 75 Ohm coax cables F-F (1m), for Rx and Tx
- NMEA multi-connector
- Installation Manual (this manual)
- Quick Guide
- Cable Relief

ACU (19” rack version)

Unpack your SAILOR 900 VSAT ACU (19” rack version) and check that the following items are present:

- 1 x Ethernet cable (2 m)
- 1 x Ethernet cable (short)
- Power connector
- 2 x 75 Ohm coax cables F-F (1m), for Rx and Tx
- NMEA multi-connector
- Installation Manual (this manual)
- Quick Guide

3.1.2 Initial inspection

Inspect the shipping cartons and wooden box immediately upon receipt for evidence of damage during transport. If the shipping material is severely damaged or water stained, request that the carrier's agent be present when opening the cartons and wooden box. Save all box packing material for future use.

WARNING! To avoid electric shock, do not apply power to the system if there is any sign of shipping damage to any part of the front or rear panel or the outer cover. Read the safety summary at the front of this manual before installing or operating the system.

After unpacking the system, i.e. removing the top and sides of the wooden box and opening the cartons, inspect it thoroughly for hidden damage and loose components or fittings. If the contents are incomplete, if there is mechanical damage or defect, or if the system does not work properly, notify your dealer.

3.1.3 Tools needed

These tools for the ADU installation are included in the delivery and mounted on a tool holder inside the radome:

- Unbraco key (5 mm)

Other tools that may be needed during the installation:

- Wrench to fasten the mounting bolts for the ADU
- Wrench to fasten the N connector at the ADU
- PC and Internet browser
- Drill for the mounting holes for the ACU

- Crimping tools

3.2 Site preparation

The following topics have to be considered when installing the ADU:

- *General site considerations*
- *Obstructions (ADU shadowing)*
- *Blocking zones – azimuth and elevation*
- *Safe access to the ADU: Radiation hazard*
- *Ship motion and offset from the ship's motion centre*
- *ADU mast design: Foundation and height*
- *Interference*
- *Other precautions*

3.2.1 General site considerations

For optimum system performance, some guidelines on where to install or mount the different components of the SAILOR 900 VSAT System must be followed.

It is recommended to mount the ADU in a location with as much **360° free line of sight to the satellite** as possible while making sure that the support structure fulfills the requirements for the mast foundation. The ADU must be mounted on stiffened structures with a minimum of exposure to vibrations.

3.2.2 Obstructions (ADU shadowing)

Place the ADU so that it has as much free line-of-sight without any structures in the beam through one full 360 degrees turn of the vessel. Do not place the ADU close to

large objects that may block the signal. To avoid obstruction elevate the ADU by mounting it on a mast or on a mounting pedestal on a deck or deck house top.

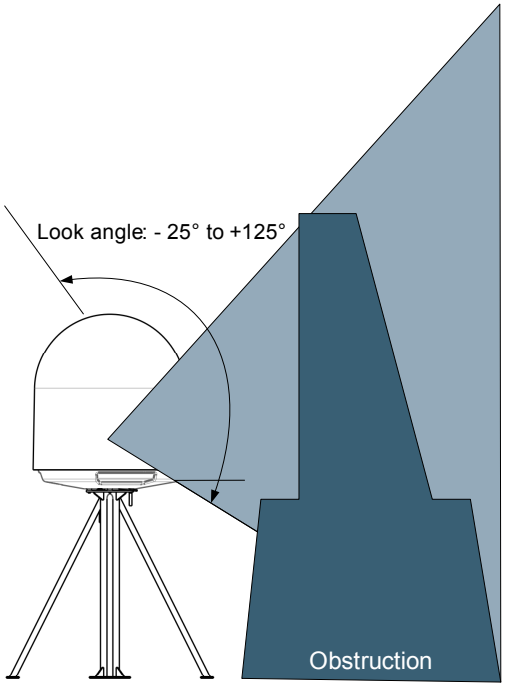


Figure 3-1: Signal degradation because of obstructing objects

The ADU is stabilized in 3-axis (plus skew) and can be used in environments with elevations of -25° to + 125° to allow for continuous pointing even in heavy sea conditions.

The ADU beam is approximately 1 m in diameter for the first 30 m from the ADU. Beyond 30 m the beam gradually widens so that it is approximately 5 m in diameter at 100 m distance. This beam expansion continues with increasing distance.

Any obstructions, such as masts, funnels, bridge house etc. within this field can cause signal degradation.

Note Please note that due to the short wavelength at Ku band and the narrow beam width of the ADU even a **6 mm steel wire placed within 50 m** inside the beam can causes signal degradation.

3.2.3 Blocking zones – azimuth and elevation

Your installation may require that you setup blocking zones for the ADU, i.e. areas where the ADU will not transmit and areas where transmit power is potentially dangerous for persons frequently being in these zones. You can set up 8 blocking zones. Each blocking zone is set up with azimuth start and stop, and elevation angle.

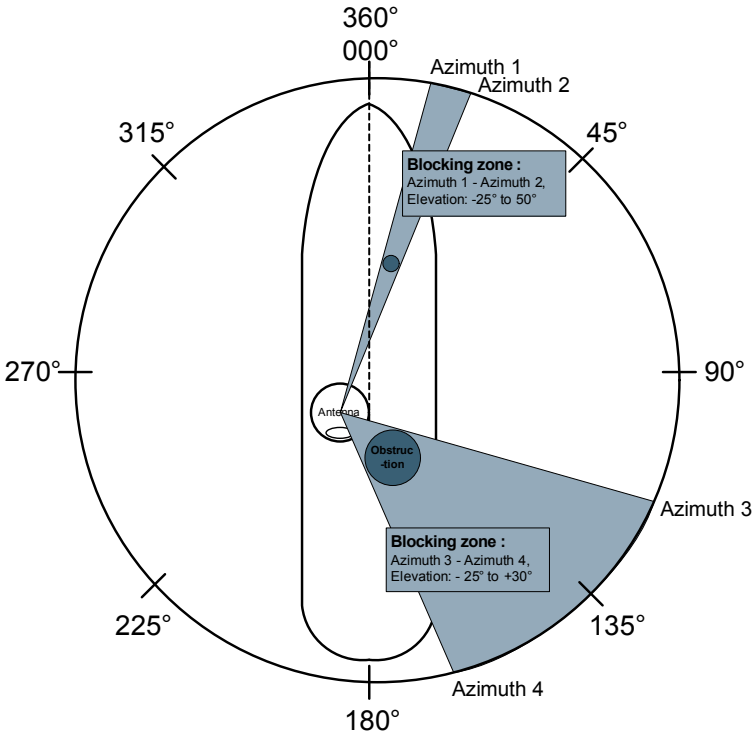


Figure 3-2: 2 blocking zones with no-transmit zones, azimuth (example)

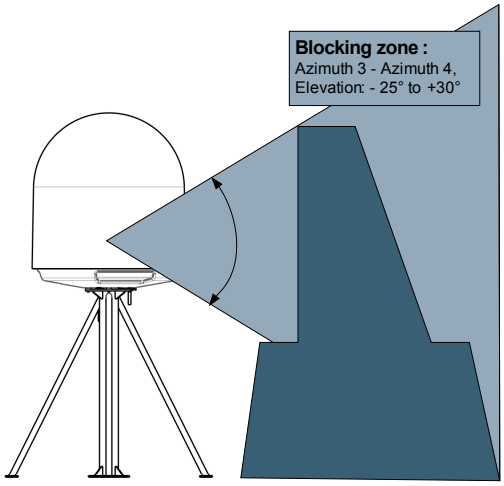


Figure 3-3: Blocking zone with no-transmit zones, elevation angle (example)

The blocking zones are set up in the SAILOR 900 VSAT built-in web interface. For further information see *Setting up Blocking zones (RX and TX)* on page 6-19.

3.2.4 Safe access to the ADU: Radiation hazard

The SAILOR 900 VSAT ADU radiates up to 49 dBW EIRP. This translates to a minimum safety distance of 30 m from the ADU while it is transmitting, based on a radiation level of 10 W/m^2.

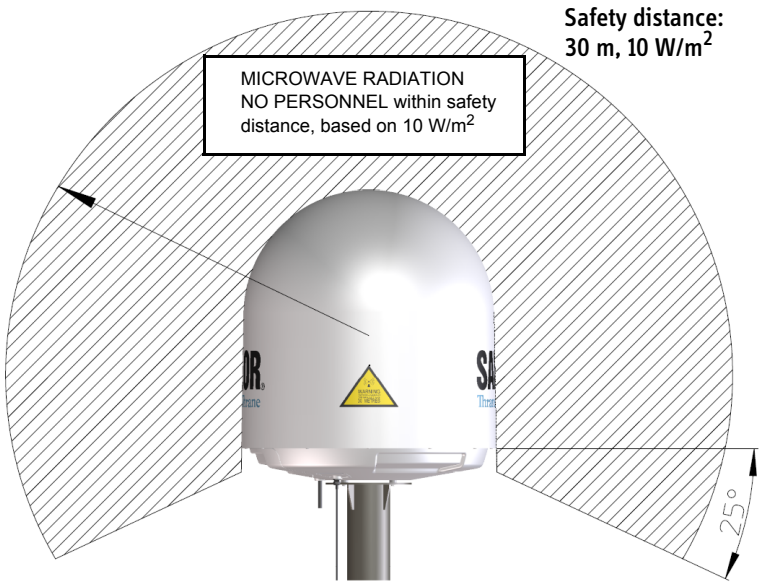


Figure 3-4: Radiation hazard, safety distance 30 m

3.2.5 Ship motion and offset from the ship's motion centre

Even though it is recommended to mount the ADU high, keep the distance between the ADU and the ship's motion centre as short as possible. The higher up the ADU is mounted, the higher is the linear g force applied to the ADU. The g force also depends on the roll period of the ship, see Table 3-1. If the g force applied is too high, performance and ADU signal stabilization may be reduced and eventually the ADU may be damaged. Refer to the following table for allowed mounting heights above the ship's motion centre.

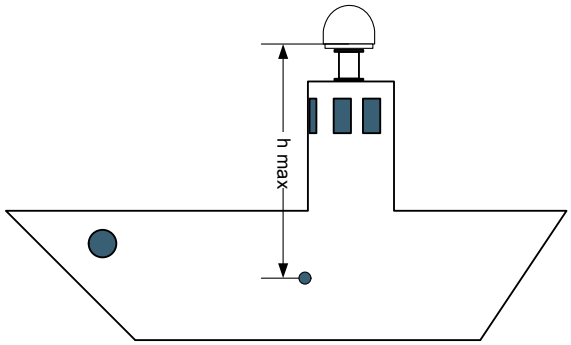


Figure 3-5: Maximum distance from the ship's motion centre (h max)

Min. roll period	Max. ADU mounting height (h max)	
	Full performance	Potential risk for damage
4 s	12 m	16 m
6 s	27 m	35 m
8 s	48 m	62 m
10 s	75 m	98 m

Table 3-1: Maximum distance from the ship's motion center versus ship's roll period

3.2.6 ADU mast design: Foundation and height

The ADU mast must be designed to carry the weight of the ADU unit, which is approximately 135 kg (+ the weight of the mast flange). The mast must also be able to withstand onboard vibrations and wind speeds up to 110 knots on the radome, even in icing conditions.

ADU mast flange

Fit the top of the ADU mast with a flange with clearance holes matching the bushings in the radome and with minimum 4 gusset plates. No center hole is necessary in the flange.

- **Flange thickness**: Minimum 15 mm.
- **4 gusset plates**: Minimum 15 mm thick, must be placed close to the holes in the mounting plate and evenly distributed.

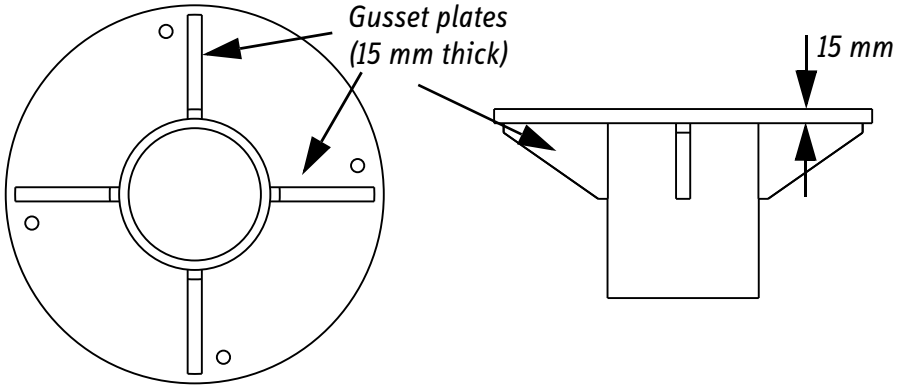


Figure 3-6: ADU mast flange, top and side view

Recommended flatness on the mast mount plateau is below 3,0 mm.

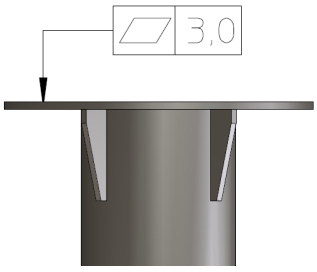


Figure 3-7: ADU mast flange, recommended flatness on the mast mount plateau

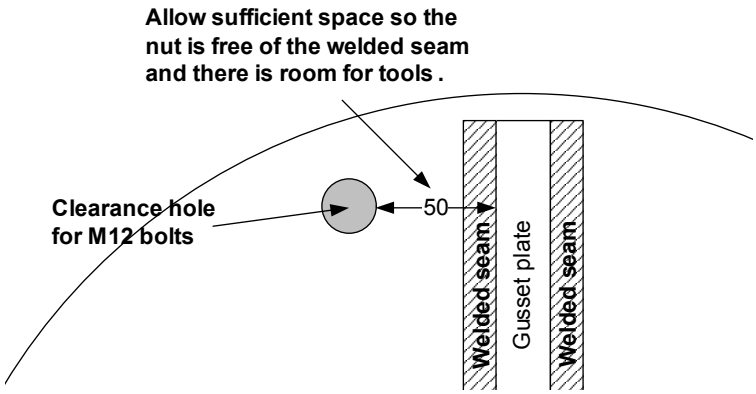


Figure 3-8: ADU mast flange, distance to the welded seam

CAUTION! Avoid sharp edges where the flange is in direct contact with the radome. Round all edges as much as possible to avoid damaging the surface of the radome.

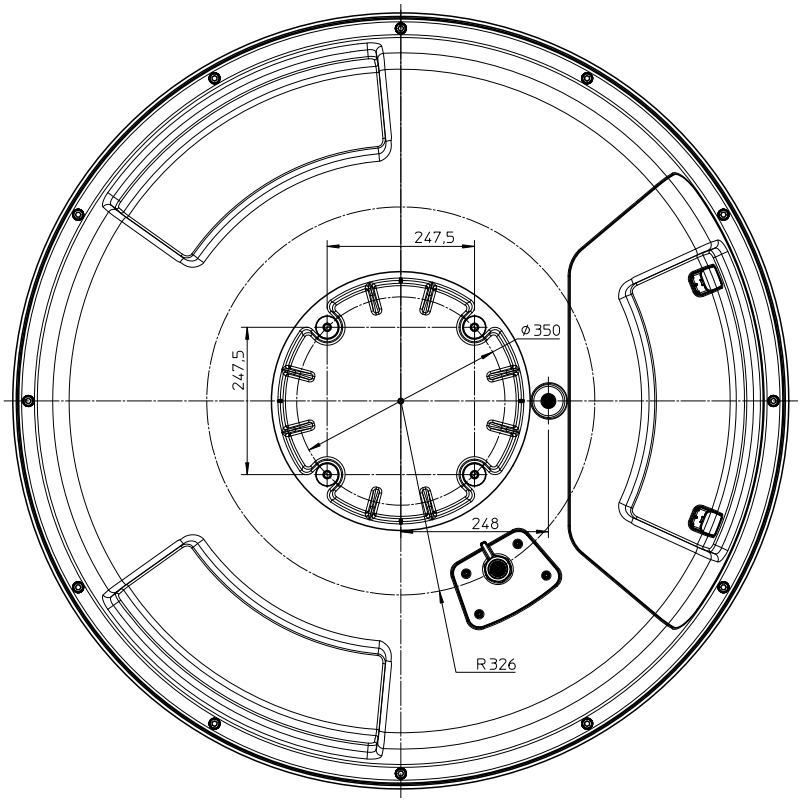


Figure 3-9: ADU, bottom view

Mast length and diameter

The placement of the ADU must ensure a rigid structural connection to the hull or structure of the ship. Parts of the ship with heavy resonant vibrations are not suitable places for the ADU. A small platform or short mast shall provide rigid support for the ADU fastening bolts and a rigid interface to the ship.

If it is necessary to use a tall mast, you must stabilise the mast with bracing. Note that the design values given below depend on rigid ADU-ship interfaces. The cross-sectional properties and the corresponding maximum free length give a natural frequency close to 30 Hz. It is recommended to shorten the mast length as much as possible to obtain higher frequencies. Preferably, mount stays or wires to stabilize the mast further.

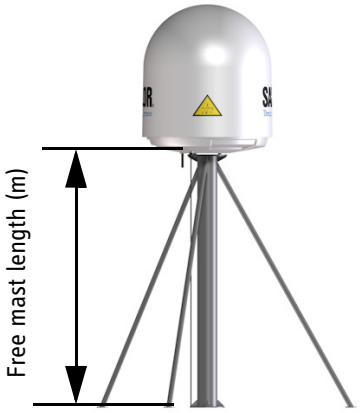


Figure 3-10: Free mast length and bracing for a tall mast

Note Make sure that there is free space below the drain tube. Read also *Condensation and water intrusion* on page 3-17.

The tables in the next sections give some suggested design values for the free mast length.

Note The tables list the values for **steel masts**. For **aluminium masts**, the free mast length is reduced to 75% of the values for steel.

Note Bracing and rigid masts can still not prevent vertical vibration if the mast is attached to a deck plate that is not rigid. Make every effort to mount the mast on a surface that is well supported by ribs. If this is not possible, provide extra deck plate propping.

SAILOR 900 VSAT ADU mast length

The below tables show the minimum dimensions for a SAILOR 900 VSAT ADU mast with and without stays or wires. Note that the values are only guidelines - always consider the environment and characteristics of the ship before deciding on the mast dimensions.

Mast without braces	Max. free mast length (steel), (m)	Outer Diameter (mm)	Wall Thickness (mm)	Weight (kg/m)
	0.4[a]	200	5	24.0
	0.6	220	5	26.5
	0.8	250	5	30.2
	1	270	5	32.7

Table 3-2: Mast dimensions without braces

a. The height of 0.4 m is not recommended to be used as it will make access through the ADU's service hatch difficult.

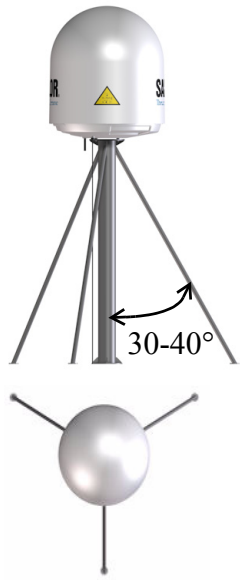
Mast with 3 braces	Max. free mast length (steel), (m)	Outer Diameter (mm)	Wall Thickness (mm)	Outer Diameter for brace (mm)	Thickness for brace (mm)
	1.2	140	10	50	5.0
	1.2	200	5	50	5.0
	1.6	140	10	70	5.0
	1.6	200	5	70	5.0
	2	160	10	70	5.0
	2	220	5	70	5.0
	2.5	180	10	80	5.0
	2.5	220	5	80	5.0

Table 3-3: Mast dimensions with 3 braces

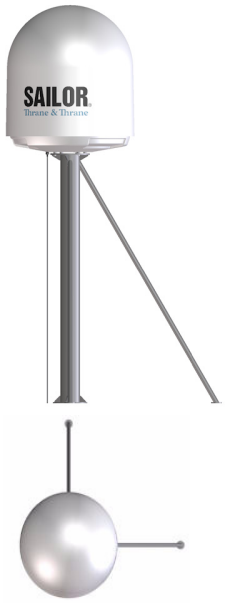
Mast with 2 braces	Max. free mast length (steel), (m)	Outer Diameter (mm)	Wall Thickness (mm)	Outer Diameter for brace (mm)	Thickness for brace (mm)
	1.2	160	10	80	5.0
	1.2	200	5	80	5.0
	1.6	180	10	80	5.0
	1.6	220	5	80	5.0
	2	180	10	80	5.0
	2	240	5	80	5.0
	2.5	200	10	80	5.0
	2.5	260	5	80	5.0

Table 3-4: Mast dimensions with 2 braces

3.2.7 Interference

Note Do not place the ADU close to interfering signal sources or receivers. For allowed distances to other transmitters see Figure 3-12: *Recommended distance to transmitters (m) for frequencies below 1000 MHz* on page 3-16. We recommend testing the total system by operating all equipment simultaneously and verifying that there is no interference.

The ADU must be mounted as far away as possible from the ship's radar and high power radio transmitters, because they may compromise the ADU performance. RF emission from radars might actually damage the ADU.

The SAILOR 900 VSAT ADU itself may also interfere with other radio systems.

Radar

It is difficult to give exact guidelines for the minimum distance between a radar and the ADU because radar power, radiation pattern, frequency and pulse length/shape vary from radar to radar. Further, the ADU is typically placed in the near field of the radar ADU and reflections from masts, decks and other items in the vicinity of the radar are different from ship to ship.

However, it is possible to give a few guidelines. Since a radar radiates a fan beam with a horizontal beam width of a few degrees and a vertical beam width of up to +/- 15°, the worst interference can be avoided by mounting the ADU at a different level – meaning that the ADU is installed minimum 15° above or below the radar antenna. Due to near field effects the benefit of this vertical separation could be reduced at short distances between radar antenna and the SAILOR 900 VSAT ADU. Therefore it is recommended to ensure as much vertical separation as possible when the SAILOR 900 VSAT ADU has to be placed close to a radar antenna.

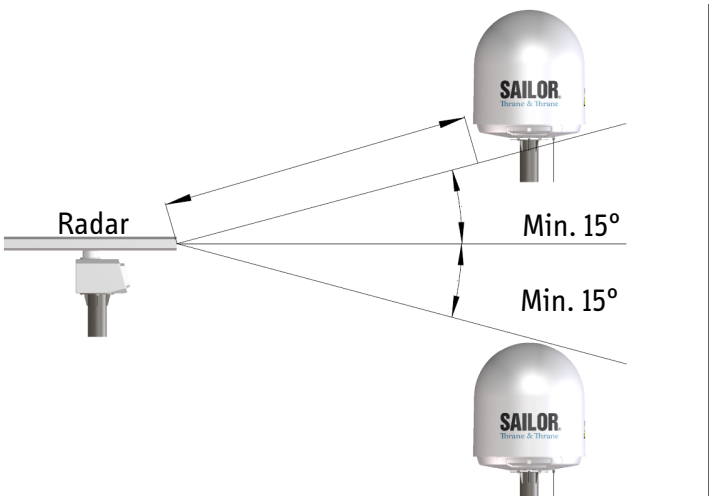


Figure 3-11: Interference with the vessel's radar

Radar distance

The minimum acceptable separation (d min.) between a radar and the ADU is determined by the radar wavelength/frequency and the power emitted by the radar. The tables below show some “rule of thumb” minimum separation distances as a function of radar power at X and S band. If the d min. separation listed below is applied, antenna damage is normally avoided.

“d min.” is defined as the shortest distance between the radar antenna (in any position) and the surface of the SAILOR 900 VSAT ADU.

X-band (~ 3 cm / 10 GHz) damage distance		
Radar power	**SAILOR 900 VSAT ADU**	
	d min. at 15° vertical separation	**d min. at 60° vertical separation**
0 – 10 kW	1.0 m	1.0 m
30 kW	2.0 m	1.0 m
50 kW	3.3 m	1.7 m

Table 3-5: Minimum radar separation, X-band

S-band (~ 10 cm / 3 GHz) damage distance		
Radar power	**SAILOR 900 VSAT ADU**	
	d min. at 15° vertical separation	**d min. at 60° vertical separation**
0 – 10 kW	2.0 m	1.0 m
30 kW	3.0 m	1.5 m
50 kW	5.0 m	2.5 m

Table 3-6: Minimum radar separation, S-band

The separation distance for C-band (4-8 GHz) radars should generally be the same as for X-band radars.

Radar interference

Even at distances greater than “d min.” in the previous section the radar might still be able to degrade the performance of the SAILOR 900 VSAT system.

The presence of one or more S or X-band radars within a radius up to 100 m may cause a minor degradation of the Ku-band connection. The degradation will be most significant at high radar pulse repetition rates.

As long as receiving conditions are favorable, this limited degradation is without importance. However, if receiving conditions are poor – e.g. due to objects blocking the signal path, heavy rainfall or icing, low satellite elevation and violent ship movements – the small extra degradation due to the radar(s) could cause poor connection quality.

The presence of S-band radar(s) is unlikely to cause any performance degradation – as long as the minimum distances (d min.) listed in the previous section are applied.

It is strongly recommended that interference free operation is verified experimentally before the installation is finalized.

CAUTION! The ADU must never be installed closer to a radar than “d min.” - even if experiments show that interference free operation can be obtained at shorter distances than “d min.” in the previous section.

GPS receivers

Good quality GPS receivers will work properly very close to the ADU - typically down to one meter outside the main beam.

Other transmitters

See the following figure for minimum recommended distance to transmitters in the frequency range below 1000 MHz.

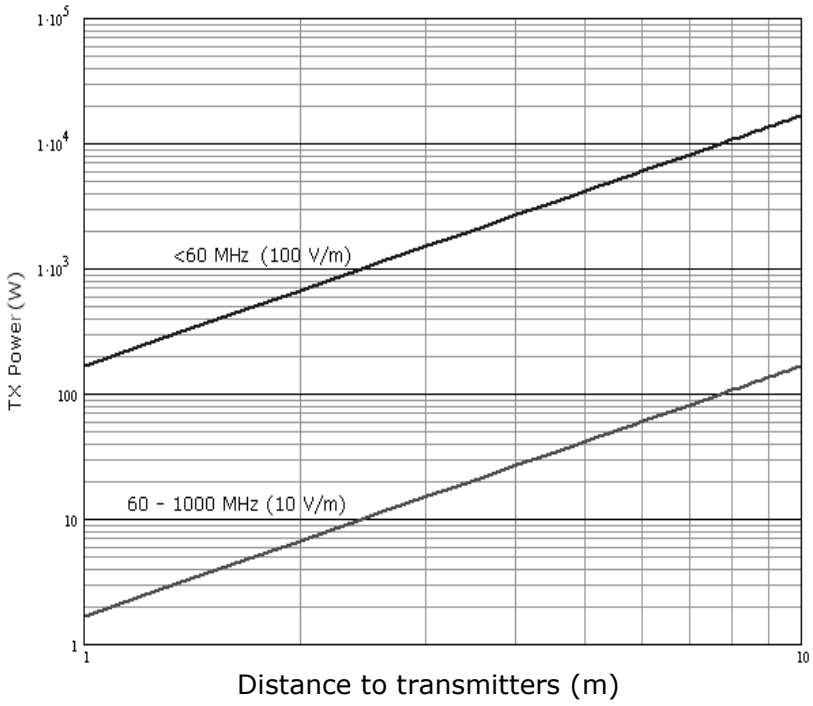


Figure 3-12: Recommended distance to transmitters (m) for frequencies below 1000 MHz

3.2.8 Other precautions

Condensation and water intrusion

If possible, install the radome such that direct spray of seawater is avoided. In some weather condition there may occur condensation inside the radome. The drain tube is designed to lead any water away from inside the radome. Make sure the ADU's drain tube is open and that there it free space between the drain tube and the mounting surface so water can escape and there is ventilation for the ADU.

Figure 3-13: Drain pipe with free space

It is recommended not to use pneumatic tools for cleaning the radome, especially at a short distance and directly at the split between top and bottom.

Deposits

Do not place the ADU close to a funnel, as smoke deposits are corrosive. Furthermore, deposits on the radome can degrade performance.

3.3 Installation of the ADU

The ADU is shipped fully assembled. You have to install it on the mast and attach the ADU cable.

WARNING! Use a strong webbed sling with a belt to lift the ADU without damaging the radome. Make sure that the sling can carry the ADU's weight (135 kg, 288 lbs).

WARNING! The ADU may be subject to swaying motions in windy conditions. Always use tag lines to stabilise the ADU during hoisting.

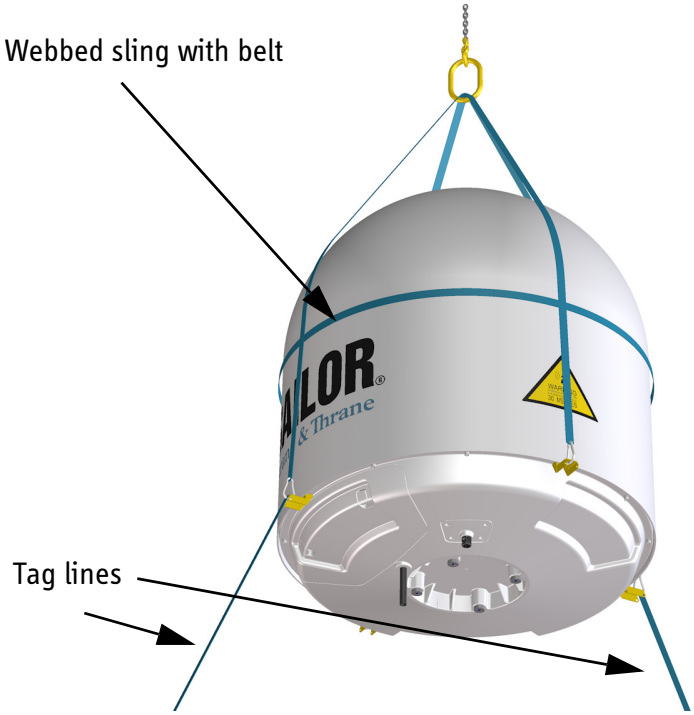


Figure 3-14: Use of strong sling with a belt and tag lines for safe hoisting

Before installing the ADU read the following guidelines.

3.3.1 Installing the ADU

Make sure that there is sufficient space underneath the ADU to open the service hatch. Through this hatch you access the ADU modules for service and maintenance.

Figure 3-15: Free space for access to the service hatch

The ADU does not have to be aligned with the bow-to-stern line of the ship. When configuring the SAILOR 900 VSAT you make an azimuth calibration to obtain the correct azimuth of the ADU.

- It is important to maintain **vertical orientation of the ADU center line**.
- Consider the aspect of interference, read more about this in *ADU mast design: Foundation and height* on page 3-8.
- Install the ADU where **vibrations are limited to a minimum**.
- Always use **all 4 bolts** when installing the ADU.

To install the ADU, do as follows:

1. Install the mast with the mast flange and have the 4 M12 bolts ready.
2. Undo all shipping buckles, take off the wooden top and remove the casing.
3. Unscrew the 4 bolts holding the ADU on the wooden platform.

4. Attach a webbed, four-part sling with a belt to all 4 lifting brackets.

Figure 3-16: ADU installation, webbed sling attached to the 4 lifting brackets

5. Attach 2 tag lines of suitable length to 2 lifting brackets and man them.
6. With a crane lift the ADU off the wooden platform and move it on top of the ADU mast.
7. Install the ADU on the mast flange with 4 M12 bolts and washers. Read carefully and follow instructions given in *Grounding the ADU* on page D-3.
   Tightening torque value: 30 Nm

Figure 3-17: Mounting the ADU on the mast flange

8. Put the coaxial ADU cable through the protection plate as shown in the following figure, and connect the N connector of the ADU cable to the ADU (see picture series below).

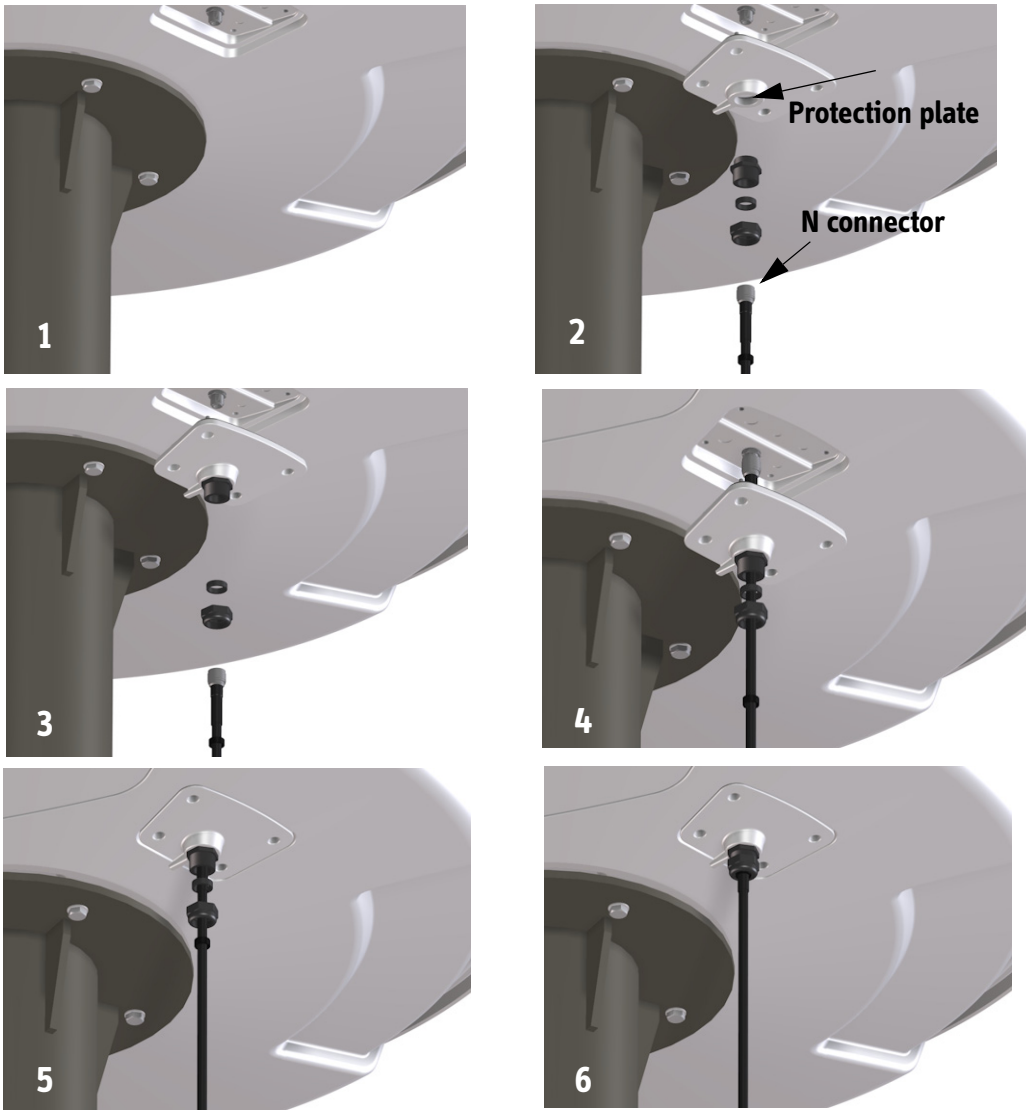


Figure 3-18: Connecting the ADU cable

Ensure that the connector assembly is properly protected against seawater and corrosion. As a minimum, wrap it with self-amalgamating rubber.

9. Put the protection plate in place and fasten the 4 bolts (picture 5).
10. Fasten the nut (picture 6).

Where the cables are exposed to mechanical wear – on deck, through bulkheads, etc. – protect the cables with steel pipes. Otherwise, follow standard procedures for cabling in ship installations.

Maximum allowed RF loss in the ADU cable: ≤ 20 dB at 1950 MHz. This is to ensure optimum performance of the system.

3.3.2 Grounding the ADU

The ADU must be grounded using the mounting bolts. If the ADU cannot or should not be electrically connected directly to the mounting surface, you can use a separate grounding cable to make the connection between the ADU and the common ground to which the ACU is also connected. If grounding to the ship ground is impossible, for example if you have a fibre glass hull, see *Alternative grounding for fiberglass hulls* on page D-7.

To obtain a good ground connection, the metal underneath the head of **at least** one bolt must be clean of insulating protective coating and a serrated washer should be used. After tightening the bolts we recommend that you seal the area suitably in order to avoid corrosion of the grounding point. Use stainless steel bolts and washers.

For further information on grounding and RF protection see *Grounding and RF protection* on page D-1.

3.3.3 Alternative ADU cable

The maximum allowed RF-loss in the ADU cable must be ≤ 20 dB at 1950 MHz and 0.9 Ohm DC. This is to ensure the performance of the system. Preferably choose one of the cable types listed in the table below.

Cable Type	Absolute maximum length
G02232-D	6 m
RG223-D	25 m
RG214/U	50 m
S 07272B-05	95 m

Table 3-7: ADU cable types and maximum lengths

Check the data sheet from the cable supplier that both the RF- attenuation and the DC-resistance are kept within the maximum specified values:

- ADU cable RF-attenuation at 1950 MHz: max. 20 dB including connector.
- ADU cable modem-attenuation at 10 MHz: Max. 2 dB
  ADU cable modem-attenuation at 36 and 54 MHz: Max. 4 dB
- ADU cable loop DC-resistance max: 0.9 Ohm.

Also ensure that the specified minimum bending radius is respected. If this is not the case, the loss in the cable will increase. Check the documentation from the cable supplier.

3.4 Installation of the ACU (bulkhead)

The following sections describe the installation of the bulkhead ACU.

Installation of the SAILOR 900 VSAT 19" Rack ACU is described in *Installing the 19" rack version of the ACU* on page 3-26.

3.4.1 Installing the ACU (bulkhead)

The cable relief for the ACU is already mounted when receiving the ACU. The cable relief is a simple system to secure cables with cable strips. It offers a number of holders to which you can secure the cables from the ACU.

1. Place the ACU on a desktop.
   If required, fasten the ACU to the desktop with 6 screws: Insert the mounting bolts (M5) through the mounting holes and into the mounting surface.
2. Make sure the grounding requirements are met. See *Grounding the ACU (bulkhead)* on page 3-24 and the appendix *Grounding and RF protection* on page D-1 for details about grounding.
3. Connect all cables. See *Interfaces of the SAILOR 900 VSAT ACU* on page 4-1 for a description of the ACU connectors.
4. Secure the cables using cable strips.

Connectors of the ACU

The ACU has the following connectors:

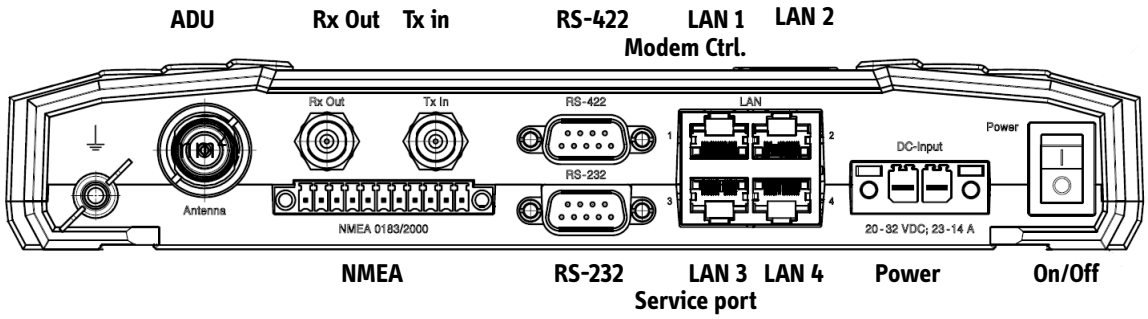


Figure 3-19: ACU, connector panel

Each connector is described in detail in *Interfaces of the SAILOR 900 VSAT ACU* on page 4-1.

For information on wiring 24 V DC power see *DC Input connector* on page 4-3.

For more information about power supply and power requirements see *Connecting power* on page 5-1.

3.4.2 Grounding the ACU (bulkhead)

Make sure that the grounding requirements are met. This is important to protect the ACU against lightning. See the appendix *Grounding and RF protection* on page D-1 for details about grounding.

ADU cable

The ADU is connected to the ACU with the ADU cable (coax cable) with an N connector at both ends. For information on ADU grounding, see *Grounding the ADU* on page 3-22.

At the ACU end, it is strongly recommended to ground the ADU cable. Use a short cable from the ACU to a grounding point and connect the short cable to the ADU cable at this grounding point, making sure the shield of the connector is properly connected.

Ground stud

To ensure that the ACU is grounded – also if the cable is disconnected from the ACU, connect an extra ground wire to the ground stud on the ACU. This ground wire must be a heavy wire or braid cable with a larger diameter than the coax cable (minimum cross section: 4 mm^2).

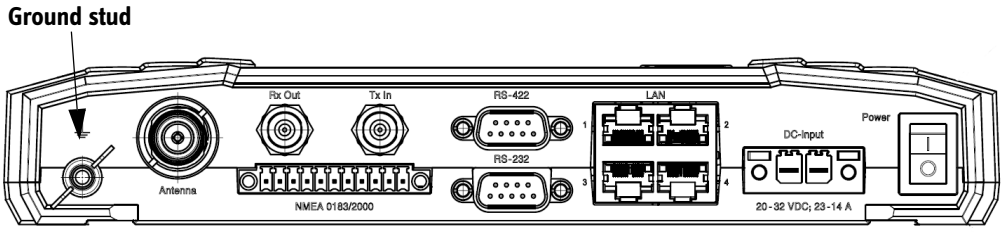


Figure 3-20: SAILOR 900 VSAT ACU, bulkhead version, ground stud

3.4.3 SAILOR 900 VSAT ACU (bulkhead) with cable support

You can mount a Cable Relief for the ACU (bulkhead). This is a simple system to which you can secure your cables using cable strips. When mounted on the ACU the cable relief offers a number of holders to which you can secure the cables from the ACU, using cable strips.

To mount the cable relief, do as follows:

1. Remove the two rubber washers from the bottom of the ACU at the connector panel end. The threaded bushings underneath the rubber washers are used for mounting the cable support.

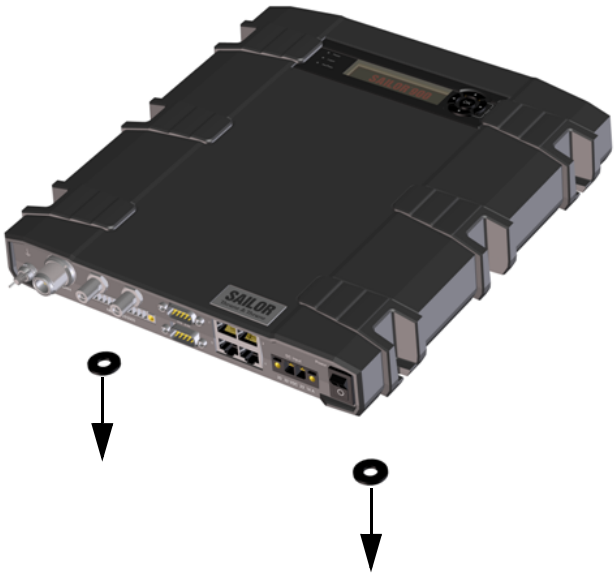


Figure 3-21: Mounting the cable relief 1/2

2. Fasten the Basic cable support to the ACU using two M4 x 6 mm countersunk screws.

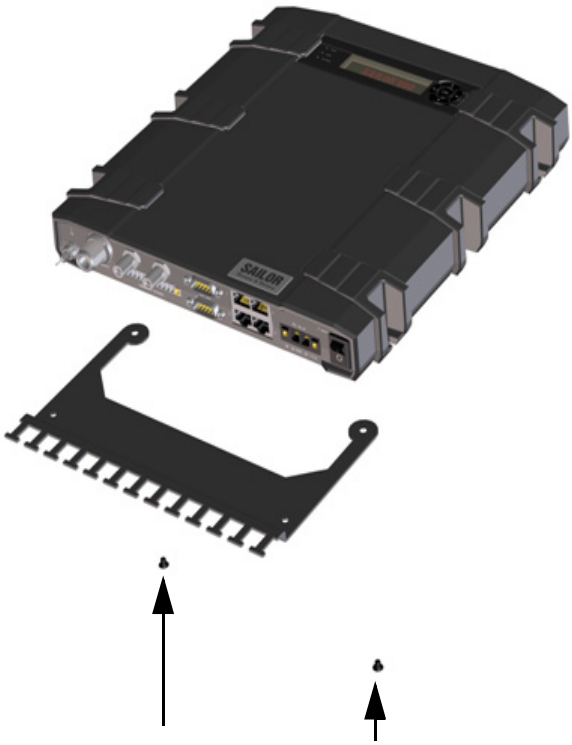


Figure 3-22: Mounting the cable relief 2/2

3. Mount the ACU by inserting 6 screws through the holes in the mounting bracket and into the mounting surface.
4. Make sure the grounding requirements are met. See *Grounding the ACU (bulkhead)* on page 3-24 and the appendix *Grounding and RF protection* on page D-1 for details about grounding.
5. Connect all cables. See *Interfaces of the SAILOR 900 VSAT ACU* on page 4-1 for a description of the ACU connectors.
6. Secure the cables to the cable relief using cable strips.

3.5 Installation of the 19” rack version of the ACU

The following sections describe the installation of the 19” rack ACU. Installation of the SAILOR 900 VSAT ACU is described in *Installation of the ACU (bulkhead)* on page 3-23.

3.5.1 Installing the 19” rack version of the ACU

A cable relief bracket is already mounted when receiving the ACU. The cable relief is a simple system to secure cables with cable strips. It offers a number of holders to which you can secure the cables from the ACU. To install the 19” rack version of the ACU, do as follows:

1. Slide the ACU into a 1U space in a 19” rack.
2. Mount the screws in each side through the holes in the front and fasten the screws to the rack. Make sure that the unit is mounted securely according to the requirements for your 19” rack.
3. Connect all cables. See *Interfaces of the SAILOR 900 VSAT ACU* on page 4-1 for a description of the ACU connectors.

Figure 3-23: ACU, 19” rack version, On/off switch at the back

Important Set the On/Off switch at the back of the ACU to On. Then you can use the On/Off switch at the front panel of the ACU 19” rack version

Connectors of the 19” rack version of the ACU

For a description of the connectors see *Connectors of the ACU* on page 3-23. The 19” rack version of the ACU has additionally a LAN connector at the front for accessing the service port from the ACU front panel.

Figure 3-24: ACU, LAN connector at the front: Service port

For information on wiring 24 VDC power see *DC Input connector* on page 4-3.

For more information about power supply and power requirements see *Connecting power* on page 5-1.

3.5.2 Grounding the 19” rack version of the ACU

Make sure that the grounding requirements are met. See the appendix *Grounding and RF protection* on page D-1 for details about grounding.

ADU cable

The ADU is connected to the ACU with the ADU cable (coax cable) with an N connector at both ends. For information on ADU grounding, see *Grounding the ADU* on page 3-22.

At the ACU end, it is strongly recommended to ground the ADU cable. Use a short cable from the ACU to a grounding point in the rack and connect the short cable to the ADU cable at this grounding point, making sure the shield of the connector is properly connected to the rack.

Ground stud at the ACU

To ensure that the ACU is grounded – also if the ADU cable is disconnected from the ACU, connect an extra ground wire from the rack to the ground stud on the ACU. This ground wire must be a heavy wire or braid cable with a larger diameter than the coax cable.

Figure 3-25: ACU, 19” rack version, ground stud

3.6 Installation of the VMU

For a list of supported VSAT modems see the SAILOR 900 VSAT data sheet. For the latest status of supported VMUs see http://extranet.thrane.com/ and click ESUPPORT.

3.6.1 General mounting considerations – VMU

1. Mount the VMU close to the ACU, preferably at a distance less than 1 m.
2. Connect all cables. See *Interfaces of the VMU* on page 4-9 for a description of the connectors for supported VSAT modems.
   For cable specifications see *VMU cable specifications* on page B-1.

Connectors and pin-out of the VMU

For connectors and pin-out see the user documentation of the VMU and *Interfaces of the VMU* on page 4-9.

Wiring Power

Provide power to the VMU as described in the user documentation of the unit.

Interfaces

This chapter is organised in the following sections:

- *Interfaces of the SAILOR 900 VSAT ACU*
- *Interfaces of the VMU*

4.1 Interfaces of the SAILOR 900 VSAT ACU

4.1.1 ACU bulkhead – LEDs, display and keypad

Figure 4-1: ACU bulkhead, LEDs, display and keypad

4.1.2 ACU 19" rack version – LEDs, display and keypad

Figure 4-2: ACU rack version, LEDs, display and keypad

4.1.3 ACU bulkhead – Connector panel – overview

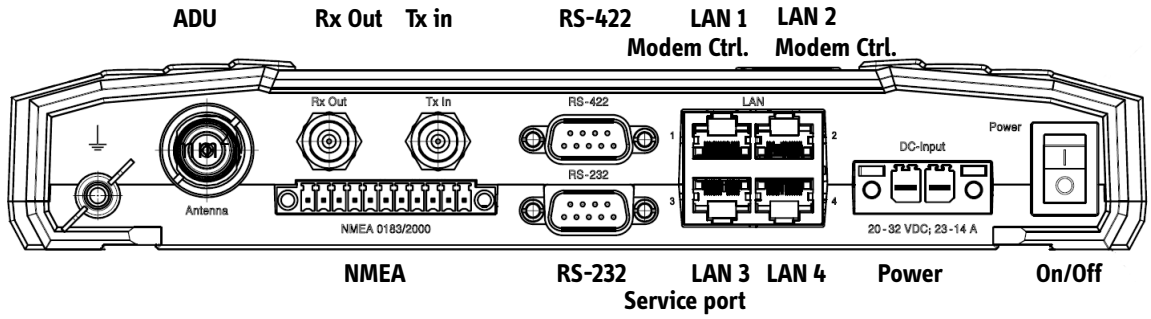


Figure 4-3: ACU bulkhead, connector panel overview

4.1.4 ACU 19” rack version – Connector panel – overview

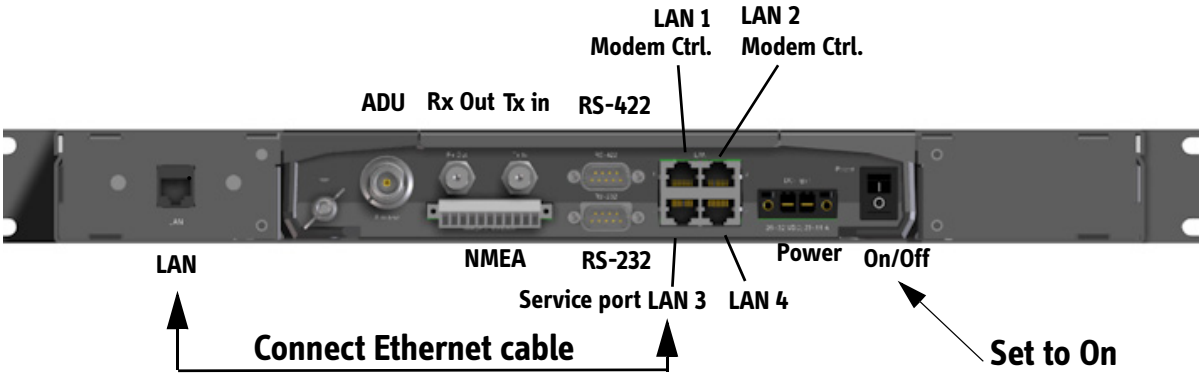


Figure 4-4: ACU rack version, connector panel overview

The connector LAN to the left is typically connected to the service port at LAN3 with a straight Ethernet cable. Then you can access the service port from the front of the ACU rack version.

Important

Set the On/Off switch at the back of the ACU to On. Then you can use the On/Off switch at the front panel of the ACU 19” rack version.

Connect the Ethernet cable to provide connection to the service port on the front of the ACU 19” rack version.

4.1.5 DC Input connector

Provide DC power to the ACU, for example by using the TT-6080A Power Supply or 24 VDC from the vessel's power supply.

DC input: Female plug (Weidmuller, Part number 1930050000) for wires up to AWG10/6 mm^2.

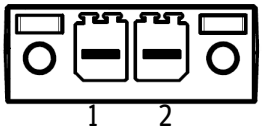
Outline	Pin number	Pin function	Wire color
	1	Vin+	Red
	2	Vin-	Black

Table 4-1: DC Input plug, outline and pin assignment

The connector for DC input is included in the delivery. Insert the power cable as shown below, and plug in the connector. Use the two red clamps to fasten the connector.

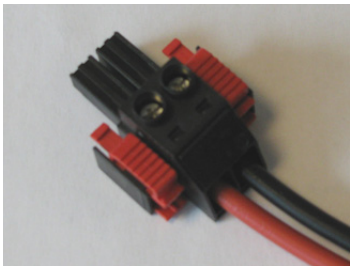


Figure 4-5: DC Input connector with power cable

For more information about power supply and power requirements see *Connecting power* on page 5-1.

4.1.6 ADU connector

There is just one cable from the ACU to the ADU. This is used to power the ADU, supply 10 MHz clock, handle all communication between ACU and ADU, and deliver the VSAT Rx and Tx signals.

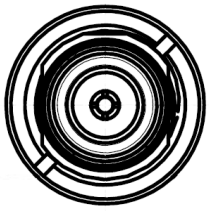
Outline	Pin number	Pin function
	1	Inner conductor: DC to ADU 10 MHz clock to ADU ACU to ADU internal communication VSAT Rx/Tx
	2	Outer conductor: GND (Shield)

Table 4-2: N connector, outline and pin assignment

Important Do not use TNC connectors on the ADU antenna cable or on pigtails. TNC connectors cannot carry the DC current for operating the ADU.

4.1.7 Rx/Tx connectors for VMU

Connect the Rx and Tx channels of the VMU to the Rx and Tx connectors of the ACU with the 2 supplied Rx/Tx cables (75 Ohm coax, F-F, 1 m).

Outline	Pin number	Pin function
	1	Inner conductor: 10 MHz clock VSAT Rx/Tx
	2	Outer conductor: GND (Shield)

Table 4-3: F connector, Rx and Tx, outline and pin assignment

For step-by-step guidelines how to set-up the VSAT modem see *VMU settings requirements* on page C-1.

4.1.8 NMEA 0183/2000 connector

(Prepared for NMEA 2000)

Connect the ship's gyro to this connector.

Outline	Pin number	Pin function	Wire color
	1	–	–
	2	NET-H (NMEA 2000)	White
	3	NET-L (NMEA 2000)	Blue
	4	NET-S (NMEA 2000)	Red
	5	NET-C (NMEA 2000)	Black
	6	–	–
	7	–	–
	8	Shields	
	9	Line B (+) NMEA 0183	
	10	Line A (-) NMEA 0183	
	11	–	–

Table 4-4: NMEA 0183/2000 connector, outline and pin assignment

NMEA 2000 power: 9-16 VDC

NMEA 2000 LEN (Load Equivalency Number): 2 (100mA)

Recommended NMEA 0183 cable

Two-wire constructed with one enclosed shield

Network signal pair:

- Size: No. 24 AWG (0.24 sq. mm) or heavier
- Characteristic impedance: 95 - 140 Ohm

- Propagation delay: 5 nanoseconds per meter, maximum
- 15 Twists (minimum) per meter

4.1.9 RS-232 and RS-422 connectors

These connectors are used to access and configure the connected VSAT modem and for ACU control. See the VSAT modem requirements for use of the RS-232 or RS-422 connector.

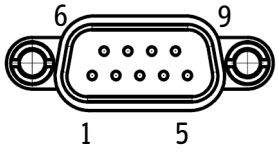
Outline	Pin number	Pin function
	1	–
	2	RXD
	3	TXD
	4	DTR
	5	Ground
	6	DSR
	7	RTS
	8	CTS
	9	Receive Signal Strength Indicator

Table 4-5: RS-232 connector, male, outline and pin assignment

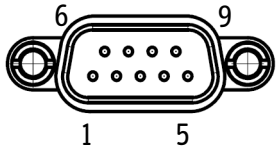
Outline	Pin number	Pin function
	1	Ground
	2	Line A RXD (+)
	3	Line B TXD (-)
	4	Ground
	5	Ground
	6	–
	7	Line A RXD (-)
	8	Line B TXD (+)
	9	–

Table 4-6: RS-422 connector, male, outline and pin assignment

4.1.10 LAN1, LAN2, LAN3 and LAN4 connectors

Four Ethernet connectors (type RJ45) for PC/laptops, routers, wireless access points. The maximum cable length per connection is 100 m. Depending on the VMU connected, a LAN connector may be used for modem control.

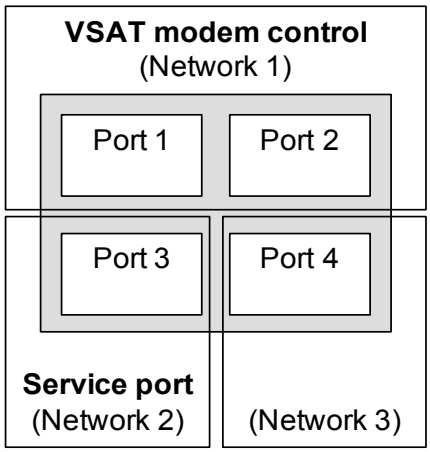


Figure 4-6: LAN1 –LAN4 connectors

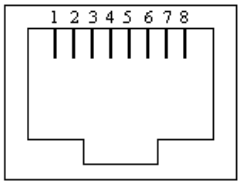
Outline	Pin number	Pin function	Wire color
	1	Tx+	white/orange
	2	Tx-	orange
	3	Rx+	white/green
	4	Not connected	blue
	5	Not connected	white/blue
	6	Rx-	green
	7	Not connected	white/brown
	8	Not connected	brown

Table 4-7: Ethernet connector, outline and pin assignment

Cable type: CAT5, shielded.

4.2 Interfaces of the VMU

For interfaces of the VMU and how to connect a VMU correctly to the ACU see the following sections and the user documentation of the VMU.

4.2.1 Connecting an iNFINITI® 5000 Series Satellite Router

Connect the VSAT modem to the ACU as shown in the figure below:

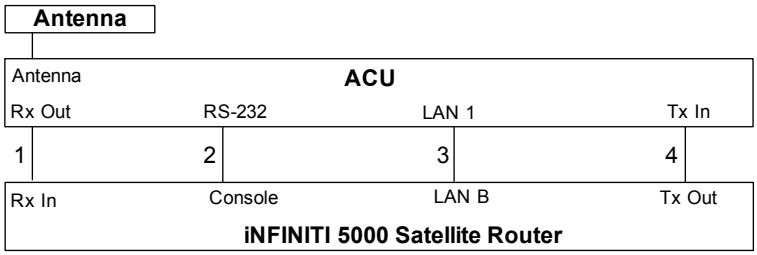


Figure 4-7: Connecting an iNFINITI® 5000 Series Satellite Router

Note Cable 3 is only used when using OpenAMIP protocol.

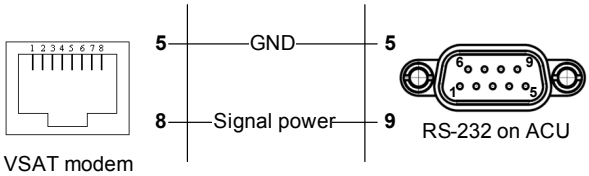
Cable	Description	Cable specifications
1	RX Out to Rx In	75 Ohm coax cables F-F (1m), included
2	RS-232 to Console	Possibly supplied together with the VSAT modem. 
3	LAN 1 or 2	Standard Ethernet cable
4	Tx In to Tx out	75 Ohm coax cables F-F (1 m), included

Table 4-8: Cables to connect an iNFINITI® 5000 Series Satellite Router

For a detailed cable specification for VSAT modems see *VMU cable specifications* on page B-1. For step-by-step guidelines how to set-up the VSAT modem see Appendix C, *VMU settings requirements*.

4.2.2 Connecting an Evolution® X5 Satellite Router

Connect the VSAT modem to the ACU as shown in the figure below:

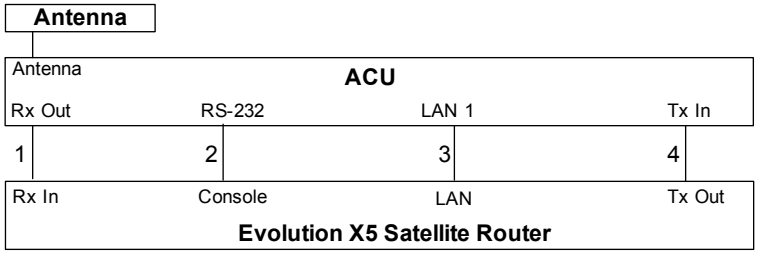


Figure 4-8: Connecting an Evolution X5 Satellite Router

Note Cable 3 is only used when using OpenAMIP protocol.

For cables see Table 4-8: *Cables to connect an iNFINITI® 5000 Series Satellite Router* on page 4-9.

For a detailed cable specification for VSAT modems see *VMU cable specifications* on page B-1. For step-by-step guidelines how to set-up the VSAT modem see Appendix C, *VMU settings requirements*.

4.2.3 Connecting a Comtech 570 L or 625 Satellite Modem

Connect the VSAT modem to the ACU as shown in the figure below:

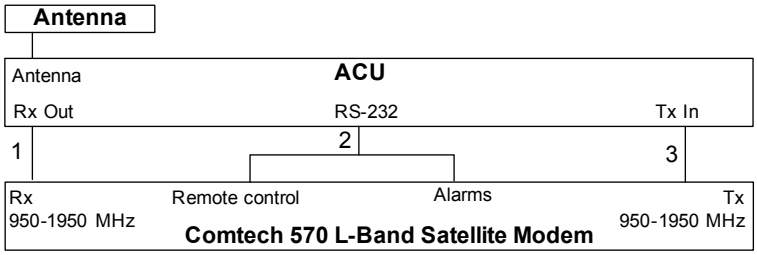


Figure 4-9: Connecting a Comtech 570 L or 625 Satellite Modem

Cable	Description	Cable specifications
1	RX Out to Rx 950-1950 MHz	75 Ohm coax cables F-F (1m) and adapter F to N 50 Ohm, included
2	RS-232 to Remote control and Alarms	37-134337-A Cable Comtech Serial and RSSI
3	Tx In to Tx 950-1950 MHz	75 Ohm coax cables F-F (1 m), included

Table 4-9: Cables to connect a Comtech 570 L-Band Satellite Modem

For a detailed cable specification for VSAT modems see *VMU cable specifications* on page B-1.

Connecting power

This chapter is organised in the following sections:

- *Power source*
- *Power cable selection*
- *Connecting power*
- *Power up*

5.1 Power source

There are different options for the power supply:

- The 24 VDC ship supply provides power for the ACU.
- An AC line provides power through an AC/DC power supply. The TT-6080A Power Supply is recommended.

Note Be aware of high start-up peak current: 35 A at 24 VDC, 5 ms.

In order to protect against short circuit in the power cable/connector, the ship's DC outlet must be protected by a 30 A fuse or circuit breaker.

5.2 Power cable selection

5.2.1 Source impedance

The maximum length of the power cable depends on the type of cable used and the source impedance of the DC power installation in the ship.

The maximum allowed source impedance depends on the usage of the power range of the terminal DC input (Start up voltage: 22 VDC guaranteed, operating range: 20 – 32 VDC; 23 A - 14 A).

Select a power outlet from the DC system and measure the source impedance of the ship installation as described in the next section.

Note If the total impedance is higher than the limits stated in section 5.2.3, the terminal may become unstable and start to on/off oscillate.

The total impedance is made up of the source impedance of the ship power supply plus the impedance of connected cables including connectors and joints where cables are extended.

For further recommendations on power cable selection, see *Power cable recommendations* on page 5-3.

5.2.2 Measuring the ship source impedance

Select a power outlet from the ship 24 VDC system and measure the source impedance of the ship installation as described below.

1. Measure the voltage without load (R.var disconnected).
2. Set the current to e.g. 1 A by adjusting R.var.
3. Measure the corresponding voltage change.

Example: 1 A and 50 mV. Source impedance: 50 mV/1 Amp = 50 mOhm.

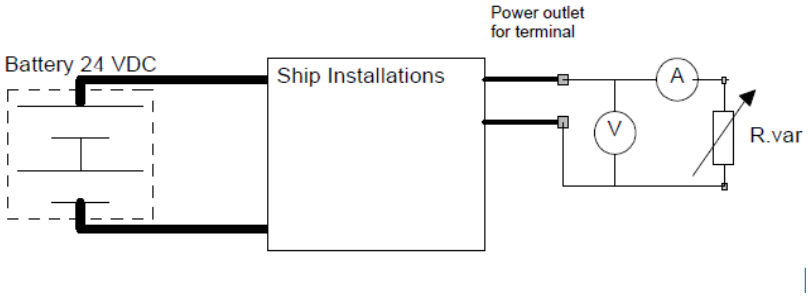


Figure 5-1: Measuring the ship source impedance

5.2.3 Power cable recommendations

Overview

The ACU is delivered with a power connector (PCB plug-in connector, female plug, Weidmuller, Part number 1930050000), which accepts wires up to AWG10/6 mm^2.

- When installing the power cable, install positive and negative supply wires closely together side by side to keep cable inductance low.
- Ensure that cable inductance for the selected cable at the desired length is less than 50 uH. Approximately 50 m maximum length.

Calculating the maximum power cable length

For 24 VDC operation, the total impedance must be max. 60 mOhm (R_{max}), including the source impedance in the ship installation (R_{source}).

The total impedance is made up of the following:

- Source impedance in the ship installation
- Impedance of the selected power cable

To calculate the maximum cable extension, do as follows:

1. First measure the source impedance in the ship installation as shown in *Measuring the ship source impedance* on page 5-2.
2. Find the resistance per meter (Rwire) for the cable type you are going to use.
   For 4 mm^2/AWG 11, the value is 4.8 mOhm/m at 55°C
   For 6 mm^2/AWG 10, the value is 3.8 mOhm/m at 55°C
   For other cable types, refer to the data sheet for the cable.

$$Maximum\ length\ =\ 0,5 \times (Rmax - Rsource)/(Rwire)$$

The length is multiplied by 0.5 above because there are two conductors in the cable.

If the TT-6080A Power Supply is used, use R_{source} = 0 mOhm.

Examples for using the TT-6080A Power Supply:

$AWG11_{max}$ =0.5 x (60 mOhm-0)/4.8 mOhm/m = 6.2 m

$AWG10_{max}$ =0.5 x (60 mOhm-0)/3.8 mOhm/m = 7.9 m

5.3 Connecting power

To connect the power cable to the ACU

1. Connect the positive and negative input terminals to the ship's DC supply according to the recommendations in the previous sections.
2. Connect the power plug to DC Input.

For information on pin-out, see *DC Input connector* on page 4-3.

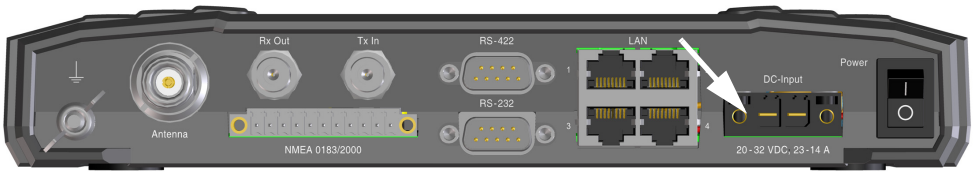


Figure 5-2: Connecting power to DC Input

5.4 Power up

1. Connect power to the VMU.
2. Switch on the ACU. The unit starts up and goes through an initialization procedure:
   - ACU POST
   - ADU Initializing
   - ADU POST
   - READY

   This may take some time (up to a couple of minutes). Now the SAILOR 900 VSAT is ready to be calibrated (for first time power up) or receive data from the VSAT modem (when in normal operation). The ACU display shows the following message:

Figure 5-3: ACU display after first power on (example with LAN ports 1 and 4 used)

   The LEDs **Power** and **Fail/Pass** are **steady green**, the LED Logon is off. For further information on status indicators see *Status signalling with LEDs and status messages* on page 9-7.

   Make sure there are no hardware failures or error codes present, check the display of the ACU for events. For more information on error codes and events see *Initial troubleshooting* on page 9-15 and *System messages* on page E-1.

3. Continue to get the SAILOR 900 VSAT system ready for use and enter the satellite and modem specific data for this installation:
   - Satellite position and polarisation
   - Cable loss and azimuth calibration
   - VSAT modem profiles
   - Satellite profiles

For step-by-step instructions see *Introduction to the built-in web interface* on page 6-1.

For installation check lists see *Installation check* on page 7-1.

Initialisation in daily use

Once the system is configured and a satellite profile is active, the startup sequence is as follows:

- ACU POST
- ADU Initializing
- ADU SW upload (If the software versions in the ADU and ACU are not the same, a software update is done during startup.)
- ADU POST
- READY
- ACQUISITION
- TRACKING

Configuration

This chapter is organised in the following sections:

- *Introduction to the built-in web interface*
- *Calibration of the SAILOR 900 VSAT*
- *Configuration with the web interface*
- *Keypad of the SAILOR 900 VSAT ACU*

6.1 Introduction to the built-in web interface

6.1.1 Overview

Use the built-in web interface of the SAILOR 900 VSAT ACU to make a full configuration of the SAILOR 900 VSAT with the correct VMU, the satellite positions you intend to use and other parameters.

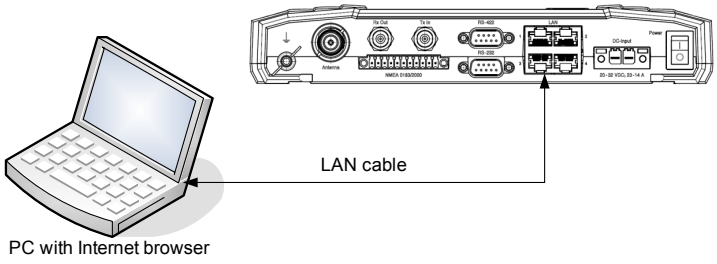


Figure 6-1: Configuration setup

For the rack version, connect the LAN cable to the front LAN connector of the ACU.

For quick start instructions see *Calibration of the SAILOR 900 VSAT* on page 6-3.

Note For information on daily use of the SAILOR 900 VSAT system refer to the SAILOR 900 VSAT Quick Guide or see chapter 8, *Daily use – Quick guide*.

No installation of software is necessary because the web interface is built into the SAILOR 900 VSAT ACU.

Browsers supported

You access the web interface from a computer with a standard Internet browser.

6.1.2 Connecting to the web interface

To connect to the web interface of the ACU do as follows:

1. Power up the SAILOR 900 VSAT system, i.e. switch on the ACU. Wait until the LEDs on the front plate of the ACU show that the system is ready to be configured.
   - Power LED: Green
   - Logon LED: Off
   - Fail/Pass LED: Flashing green, during power-on self test, after that steady green.
2. Set up your PC network connection to use a static IP address:
   - IP: 192.168.0.2
   - Subnet mask: 255.255.255.0
   - Gateway: 192.168.0.1

   For more detailed instructions and proxy server settings see *Overview and navigation* on page 6-8.
3. Connect a PC to LAN interface 3 (Service port, standard Ethernet) of the ACU. For the rack version connect the LAN cable to the front LAN connector of the ACU.

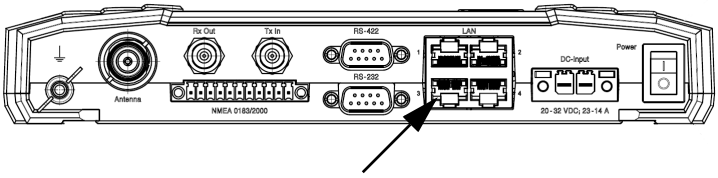


Figure 6-2: LAN connector used for configuring the SAILOR 900 VSAT

4. Open your Internet browser and enter the IP address of the ACU. The IP address is **http://192.168.0.1** (default).

5. The web interface opens directly with the **DASHBOARD** page.

Figure 6-3: SAILOR 900 VSAT Dashboard

For a detailed introduction to the web interface see *Overview and navigation* on page 6-8.

6.2 Calibration of the SAILOR 900 VSAT

You must align the ADU with the vessel's gyro compass. To do this, you make an azimuth calibration, i.e. you determine the offset of the ADU zero direction to the bow-to-stern line of the ship. This procedure is fully automatic.

Before you can do the calibration you must define a Service profile. After that, you create the satellite and VSAT modem profiles you want to use during normal operation. You must also set up blocking zones for the specific installation.

For a detailed introduction to the web interface see *Overview and navigation* on page 6-8.

6.2.1 Setting up a service profile for calibration

To set up a service profile for calibration, do as follows:

1. Add a VSAT modem profile for calibration. This is not a physical modem, but a 'virtual' modem used for azimuth calibration of the antenna. Click **SETTINGS > VSAT modem profiles > New entry.**
2. Enter a name for the service profile, for example: Service.
3. In the drop-down list **VSAT modem** select **Service**.
4. Click **Apply**. The service profile is added to the list of VSAT modem profiles.

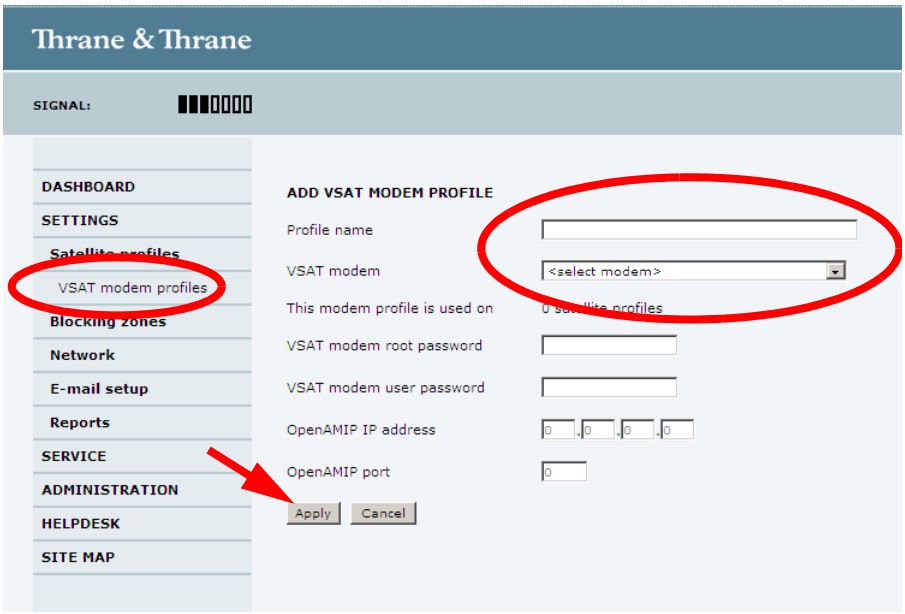


Figure 6-4: Service profile, add a Service 'modem' for calibration

5. Select **Satellite profiles** > **New entry**. Enter the name of the satellite profile for calibration (a name of your own choice) and select the VSAT modem Service (created in step 3.), click **Apply**.

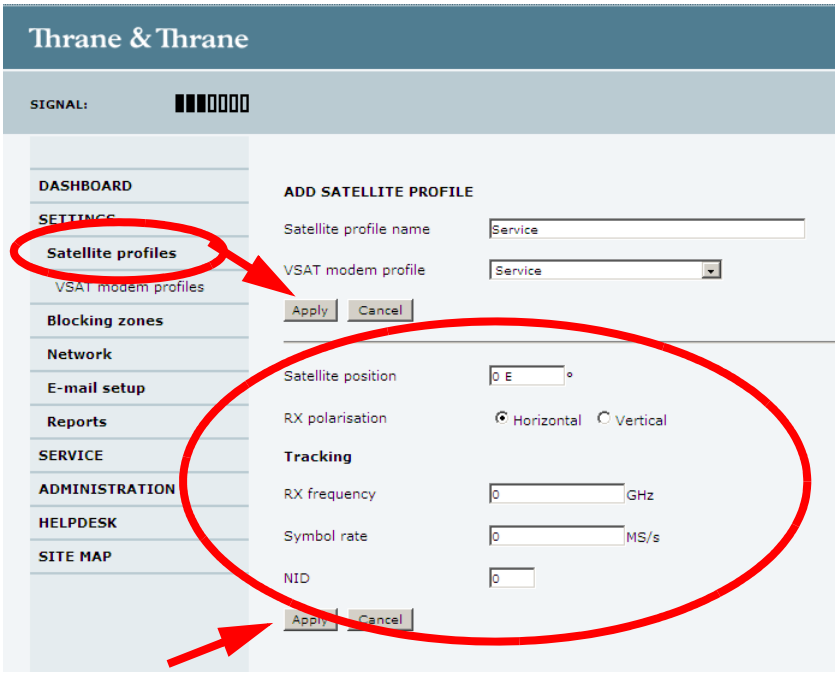


Figure 6-5: Service profile, add satellite information

6. Enter data from the satellite you want to use as a calibration reference. For satellite data see for example www.lyngsat.com and click **Apply**.

   Make sure that the following requirements for the satellite are met:

Satellite requirements for successful calibration	
Elevation	Elevation angle: 10 – 60 degrees Not allowed for calibration: Inclined orbit.
System encryption	DVB-S or DVB-S2
NID	Preferably a unique NID (ONID). An azimuth calibration without NID can be useful in regions where the satellite operators do not broadcast NID (US, China, Australia etc.).
Polarisation	Horizontal or vertical polarisation. Not allowed: Left-hand circular (L) or right-hand circular (R).

Table 6-1: Satellite requirements for elevation and carrier

Now the system is ready for the azimuth calibration.

6.2.2 Calibration of azimuth and cable

Note First you must set up a service profile, see 6.2.1.
The ship must not move during the calibration procedure.
The satellite must be visible from the location of the installation.

The calibration has 2 steps: Azimuth calibration and cable calibration.

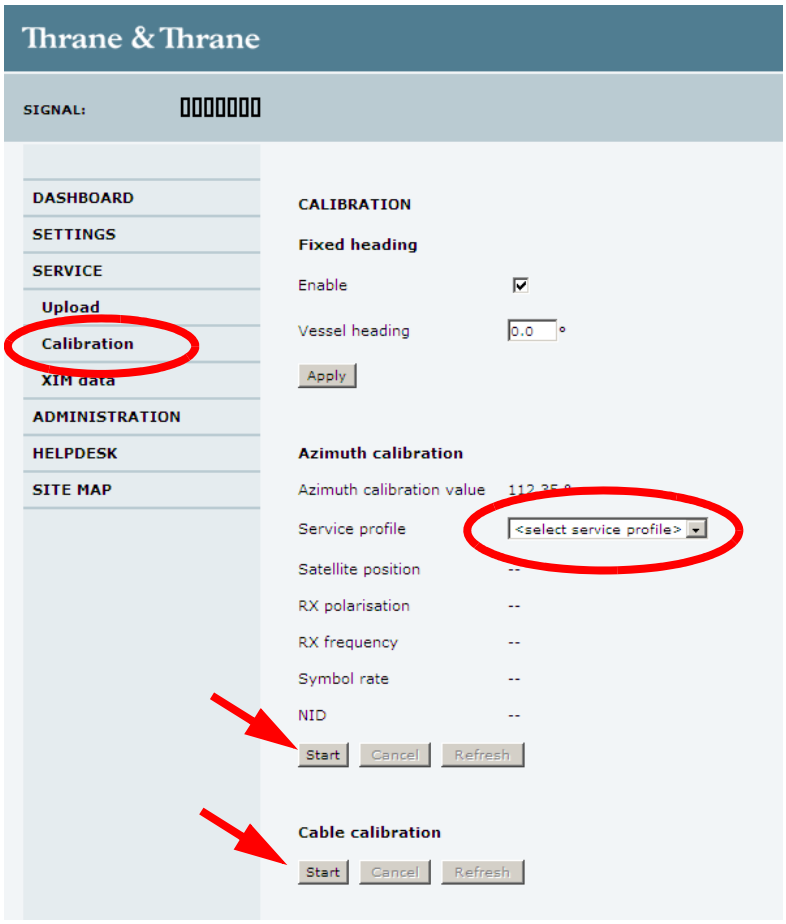


Figure 6-6: Web interface: SERVICE, Calibration: Azimuth and cable

1. Click **SERVICE > Calibration**.
2. If needed, you can enable fixed heading and enter the fixed heading in degrees. This is useful for training, test and fixed installations like remote areas or oil rigs etc. Then click **Apply**.

3. Select the service profile in the drop down list, for example **Service**. All profiles with the VSAT modem Service are displayed in the list.

Important

Do not refresh the browser during calibration, this will interrupt and restart the calibration procedure. The screen is not automatically updated when new data are available from the SAILOR 900 VSAT. You may click the button **Refresh** in the web interface to update the screen.

4. Click **Start** in the section **Azimuth calibration** and wait 5 minutes for the calibration to finish. After finished calibration click the button **Refresh**. Then a message is displayed when the calibration has been completed successfully.
5. Click **Start** below **Cable calibration** and wait 10 minutes for the calibration to finish. After finished calibration click the button **Refresh**. Then a message is displayed when the calibration has been completed successfully.

The SAILOR 900 VSAT is calibrated now.

If the calibration failed there will be an alarm symbol in the icon bar ⚠, and the ACU display will show a warning or error.

6.3 Configuration with the web interface

6.3.1 Overview and navigation

Topics in the web interface

Use the site map to get an overview over the existing menus, submenus and topics. You can click on each menu in the site map to go directly to the page or display the respective submenu.

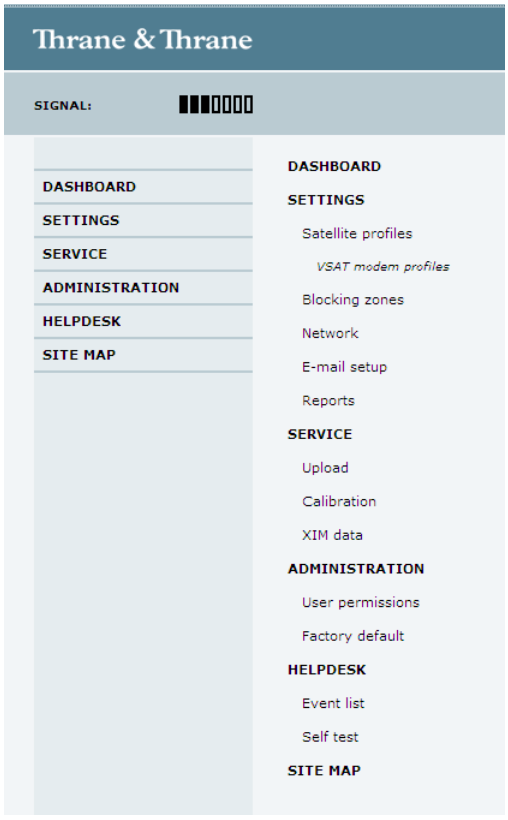


Figure 6-7: Topics in the web interface (SITE MAP)

Navigation

The web interface consists of the following sections:

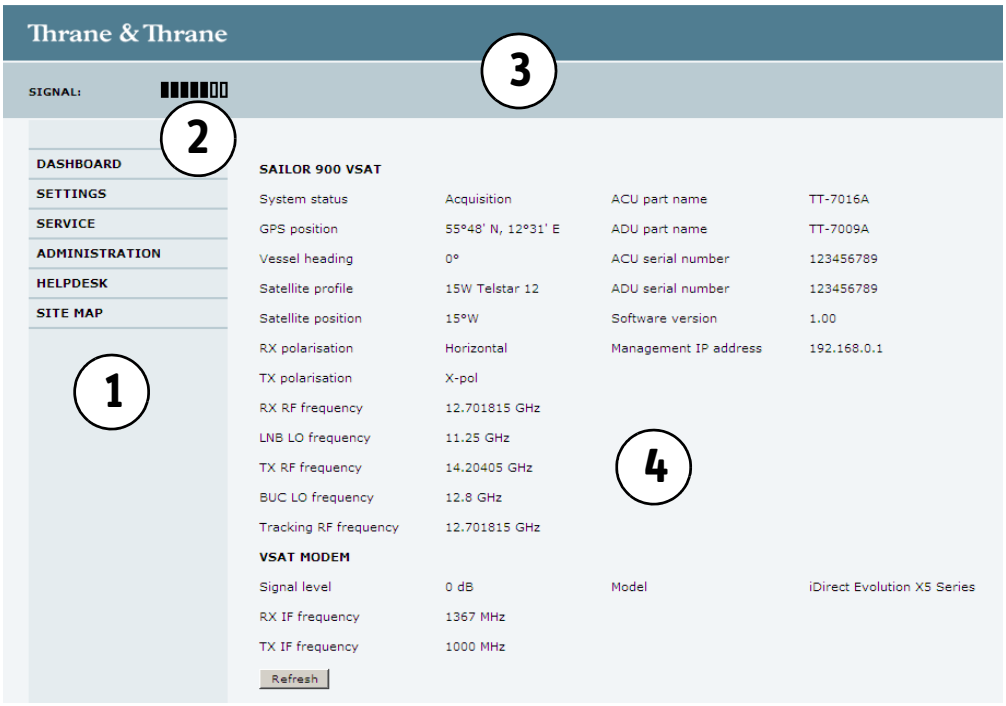


Figure 6-8: Sections of the web interface

1. The **navigation pane** holds the main menu. Clicking an item in the menu opens a submenu in the navigation pane or a new page in the contents section.
2. The **signal status field** shows the signal strength. The signal strength can vary during operation, depending on the current position relative to the satellite and the call or data session activity.
3. The **icon bar** shows icons for active events, when relevant. For explanations of the icons, see the next section, *Icons in the icon bar*.
4. The **contents section** shows the page selected in the navigation pane. This section is used for viewing or changing settings, or for performing actions.

When the Dashboard is displayed you have verified that the connection to the SAILOR 900 VSAT can be established. The web interface is ready for use. You can continue to configure the system.

If you cannot establish a connection there might be problems with the Proxy server settings of your PC. See *Proxy server settings in your browser* on page 6-10 for further information.

Icons in the icon bar

The following icons may appear in the icon bar in the web interface:

Icon	Explanation
⚠	An event is active. Click the icon to see a list of active events. For explanations of the event messages, see *Event messages – overview* on page E-1. Note that this icon will remain in the icon bar as long as the event is active.

Table 6-2: Web interface: Icons

Navigating the web interface

- **To expand a menu**, click the menu in the navigation pane.
- **To access status and settings**, click the relevant subject in the navigation pane or click the relevant icon in the icon bar. The status or settings are displayed in the contents section.
- **To get an overview over the submenus available use the site map**, click **SITE MAP** in the navigation pane. Click on items in the site map to go directly to the relevant location.

Note You can give access to some configuration settings for users that are not administrators. For information on how to set up user permissions, see *Setting up user permissions* on page 6-31.

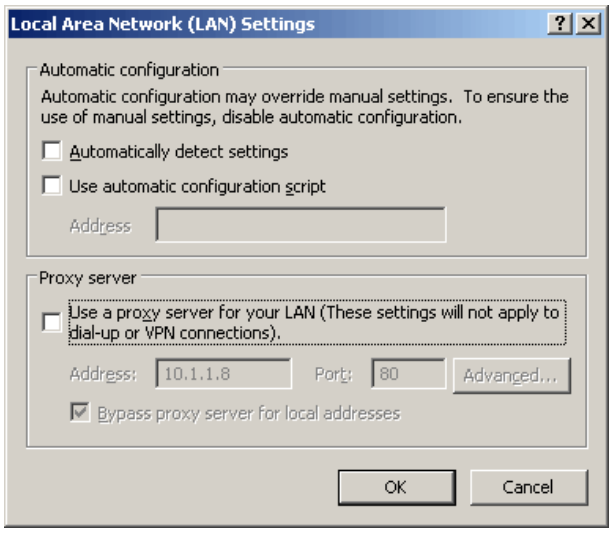
Proxy server settings in your browser

If you are connecting your computer using a LAN or WLAN interface, the **Proxy server** settings in your browser must be disabled before accessing the web interface. Most browsers support disabling of the Proxy server settings for one specific IP address, so you can disable Proxy server settings for the web interface only, if you wish. Consult your browser help for information.

To disable the use of a Proxy server completely, do as follows:

Note The following description is for **Microsoft Internet Explorer**. If you are using a different browser, the procedure may be different.

1. In Microsoft Internet Explorer, select **Tools > Internet Options > Connections > LAN Settings**.



2. Clear the box labeled **Use a proxy server for your LAN**.
3. Click **OK**.

When the proxy server settings are disabled, close and restart your browser.

You may need to change this setting back on return to your Internet connection.

Setting up a static IP address for your network connection

To set up your PC to a static IP address, do as follows (example for Windows XP):

1. Go to **Start** > **Settings** > **Control Panel** > **Network Connections**.
2. Right-click on the **LAN connection** you want to use.
3. Select **Properties**, highlight **Internet Protocol (TCP/IP)**.
4. Click **Properties**.
   - Make sure that the following is selected:
     - Use the following IP address (works for ACU default IP 192.168.0.1):
     IP address: 192.168.0.2, Subnet mask: 255.255.255.0, Default gateway: 192.168.0.1
     - Use the following DNS server addresses: Not used.

6.3.2 Using the Dashboard

The Dashboard is the first screen that is displayed when the user or administrator enters the IP address of the web interface of the ACU. The Dashboard is used for set up and selection of satellite and modem profiles, control and inspection of ongoing communication and for viewing properties and status of the ACU and ADU.

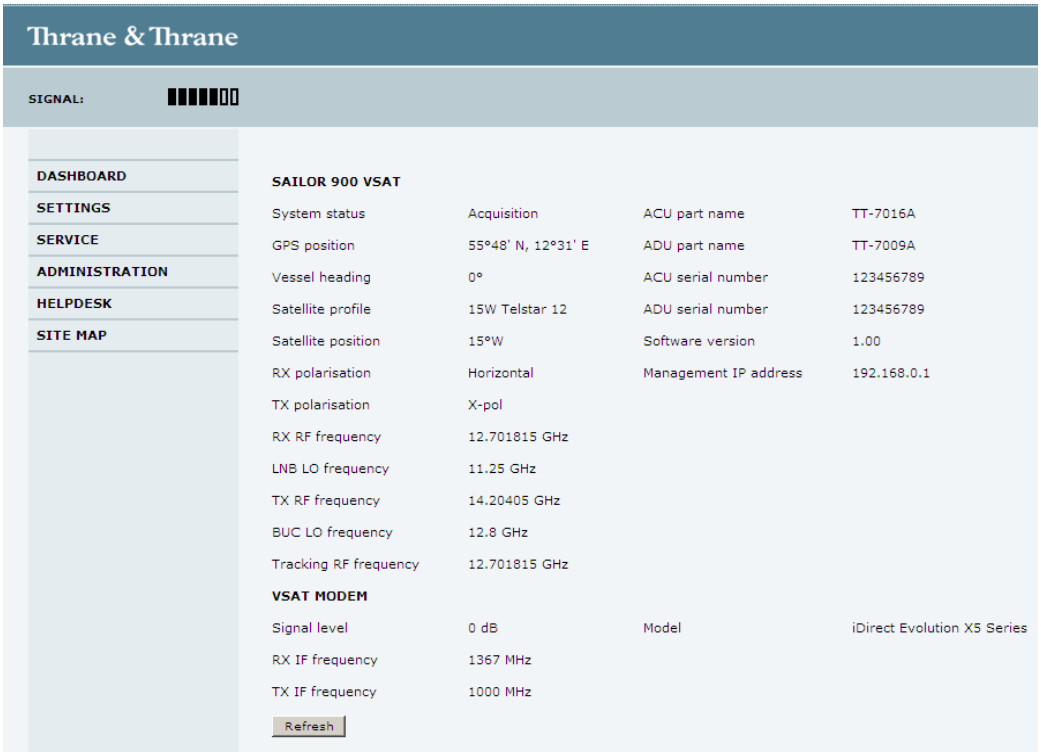


Figure 6-9: Web interface: DASHBOARD

SAILOR 900 VSAT parameter	Description
System status	Current status of the SAILOR 900 VSAT. Examples: READY (Waiting for data from the VSAT modem or no satellite profile selected), ACQUISITION (Locating the satellite and acquiring the signal), TRACKING (Tracks the current satellite, operational TX BLOCKING ZONE (Antenna is pointing in a no TX zone) RX/TX BLOCKING ZONE (Antenna is pointing into a blocking zone, TX is off) SERVICE SWITCH (Service switch in ADU activated) SAFE MODE (Error, followed by an error description)
GPS position	Current position of the vessel, reported by the GPS module
Vessel heading	Ship's heading in degrees with reference to North, provided by the ship's gyro.
Satellite profile	Name of the currently active satellite profile.
Satellite position	Entered in EDIT SATELLITE PROFILE
RX polarisation	Horizontal or vertical, entered in EDIT SATELLITE PROFILE
TX polarisation[a]	Co-pol or X-pol, auto-selected by VSAT modem
RX RF frequency[a]	Ku band receiving frequency, auto-selected by VSAT modem
LNB Lo frequency[a]	Auto-selected by VSAT modem
TX RF frequency[a]	Auto-selected by VSAT modem
BUC Lo frequency	12.8 GHz (system parameter)
Tracking RF frequency	Enter in satellite profile.

Table 6-3: Web interface, SAILOR 900 VSAT parameters on DASHBOARD

SAILOR 900 VSAT parameter	Description
ACU part name, ADU part name, ACU serial number, ADU serial number, Software version	Part names, serial numbers for ACU and ADU, software version of the SAILOR 900 VSAT, read out from the units connected.
Management IP address	IP address of the web interface for configuration of the SAILOR 900 VSAT. (Use LAN3 service port).

Table 6-3: Web interface, SAILOR 900 VSAT parameters on DASHBOARD (Continued)

a. Can be altered when using a generic modem profile.

VSAT MODEM parameter	Description
Signal level	Current input signal level from VSAT modem. iDirect openAMIP modem: (PWR) 0-500, delivered by the connected modem. For values <250 the antenna searches after a new signal. Other modem: Signal level in dB.
RX IF frequency	Read out from VMU.
TX IF frequency	Read out from VMU.
Model	VSAT modem name, entered in **SETTINGS** > **VSAT modem profiles**.

Table 6-4: Web interface, VSAT MODEM parameters on DASHBOARD

6.3.3 Satellite profiles and VSAT modem profiles

Satellite profiles

On the page **Satellite profiles** you add, edit and delete satellite profiles. A satellite profile contains all settings that are necessary for a successful connection to the satellite, including a VSAT modem profile. Most of the data you have to fill in are provided by your VSAT service provider.

You must activate one satellite profile.

Note You must add at least one VSAT modem profile before you can add a satellite profile. See *VSAT modem profile – New entry and Edit* on page 6-17.

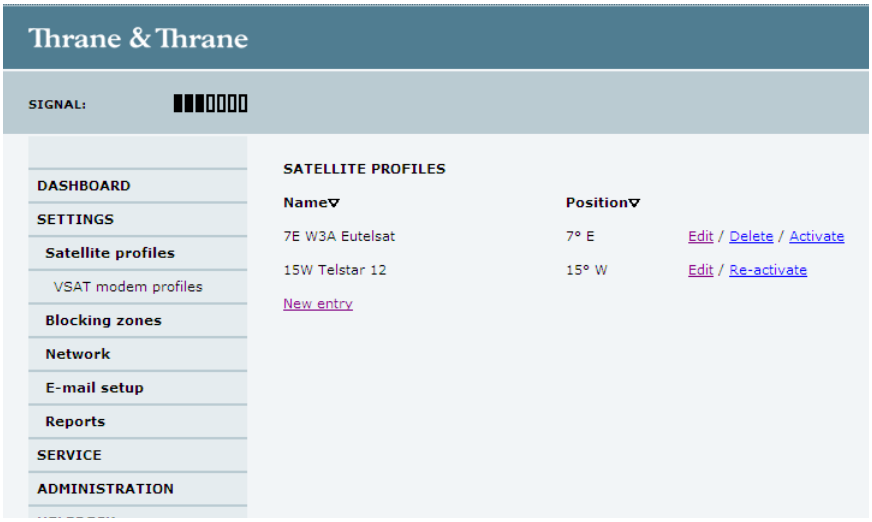


Figure 6-10: Web interface: SETTINGS - list of satellite profiles (example)

Satellite profiles – New entry and Edit

Each satellite profile has one assigned VSAT modem profile.

Figure 6-11: Web interface: SETTINGS, Satellite profiles – new entry (example)

To add or edit a satellite profile, do as follows:

1. Go to **SETTINGS or Satellite profiles** and click **Edit** or **New entry**.
2. Enter or edit the Satellite profile name.
3. Select a VSAT modem profile and click **Apply** to proceed.
   For instruction how to add a VSAT modem profile see *VSAT modem profile – New entry and Edit* on page 6-17.
4. Fill in or edit the satellite details and click **Apply**.

VSAT modem profiles

A VSAT modem profile contains all VSAT modem settings that are necessary for a successful connection to the satellite. The data you have to fill in are provided by your VSAT service and modem provider. You must add at least one VSAT modem profile.

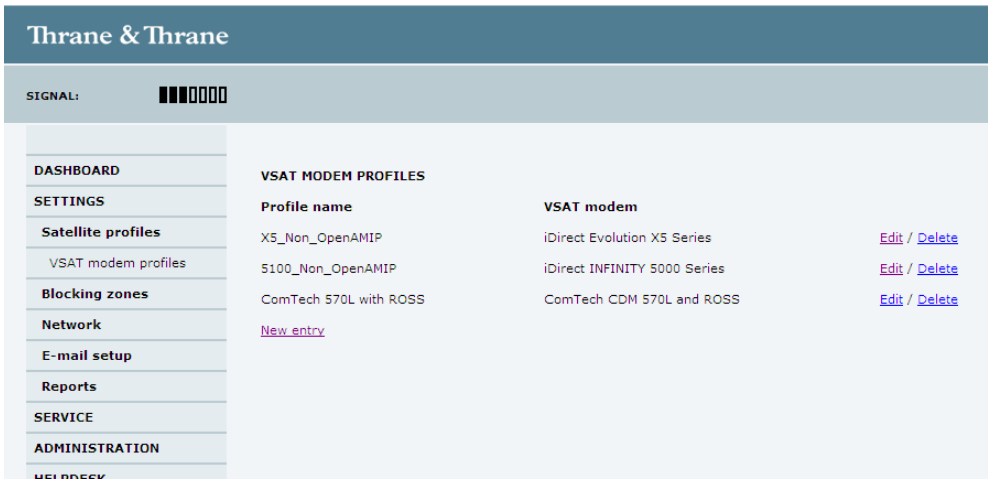


Figure 6-12: Web interface: SETTINGS, VSAT modem profiles – list (example)

To create a new VSAT modem satellite profile, click **New entry**. To edit or delete a VSAT modem profile, click **Edit** or **Delete**.

VSAT modem profile – New entry and Edit

On the page **VSAT modem profiles** you create, edit or delete VSAT modem profiles. The supported VSAT modem profiles are listed in the drop-down list **VSAT modem profile**. The VSAT modem named Service is a modem profile used during azimuth calibration.

To add or edit a VSAT modem profile, do as follows:

1. Go to **SETTINGS** > **VSAT modem profiles** and click **New entry** or **Edit**.

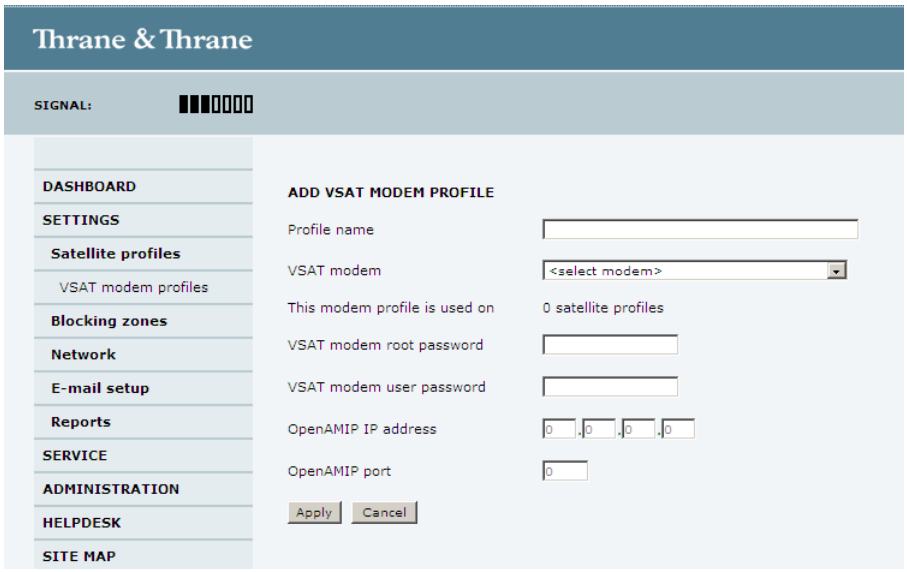


Figure 6-13: Web interface: SETTINGS, VSAT modem profiles – new entry (example)

2. Fill in a VSAT modem profile name of your own choice.
3. Select one of the supported VSAT modems.
4. Fill in or edit the data provided by your VSAT service provider.
   For OpenAMIP IP address: Make sure that you have entered this IP address also for the LAN connector that is used for the OpenAMIP modem, see *Configuring the LAN network* on page 6-21.
5. Click **Apply** to add the new profile to the list of VSAT modem profiles or to accept the edits.

Generic modem

If you have a modem that is not included in the list you can select the generic modem. This is mainly used for troubleshooting purposes.

6.3.4 Setting up Blocking zones (RX and TX)

On this page you define blocking zones, i.e. NO TX and RX zones, enter azimuth values and elevation angles for each blocking zone. You must select **Active** to enable a blocking zone.

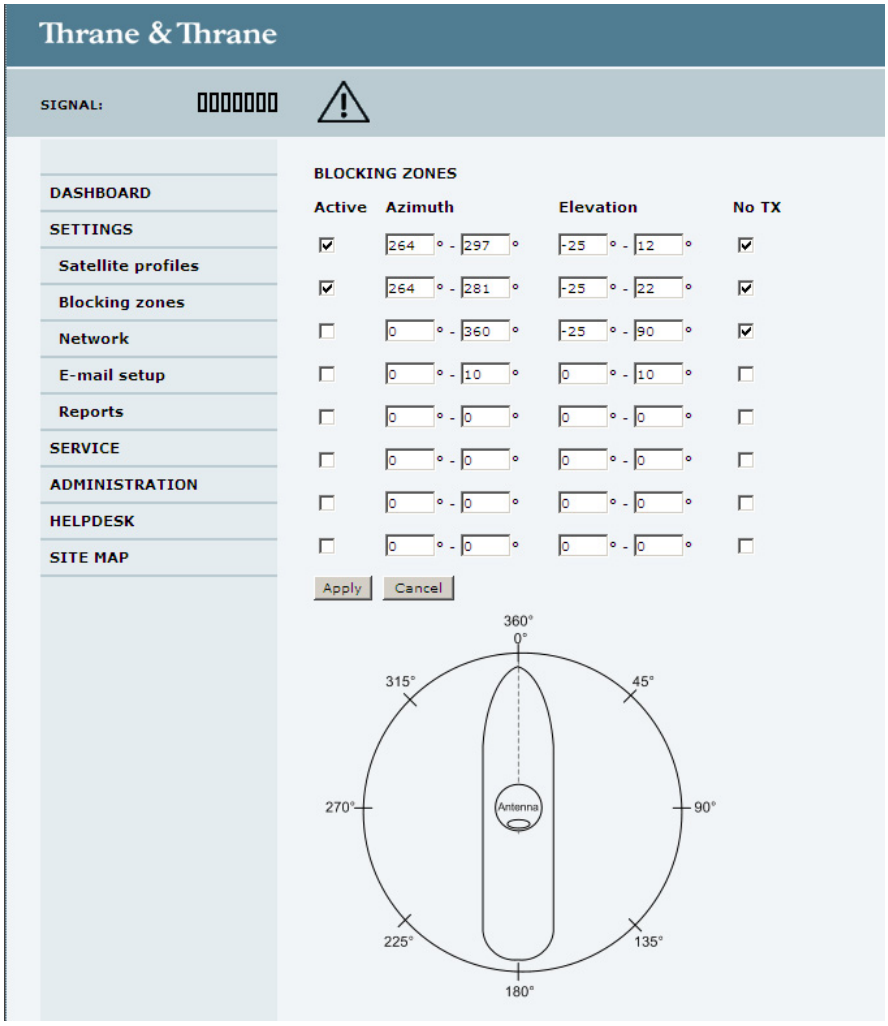


Figure 6-14: Web interface: SETTINGS, Blocking zones – azimuth and elevation

To define and set a blocking zone, do as follows:

1. Select **SETTINGS > Blocking zones**.
2. Select **Active** to enable the blocking zone.

3. **Azimuth:** Enter start and stop azimuth value in degrees for the blocking zone. Values allowed: 0 to 360 degrees. Enter clockwise.

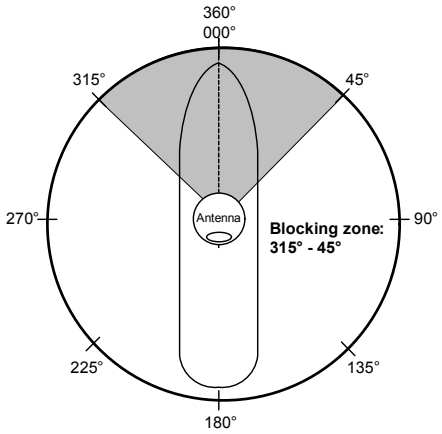


Figure 6-15: Blocking zone, example: 315 - 45 degrees

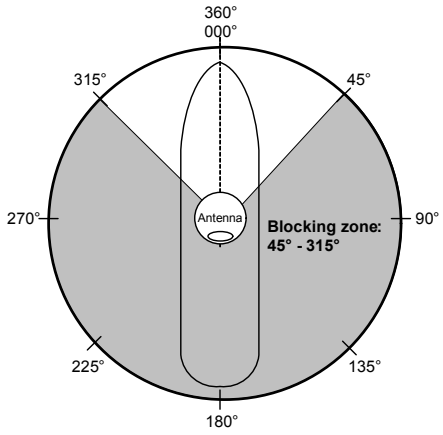


Figure 6-16: Blocking zone, example: 45 - 315 degrees

4. **Elevation:** Enter the start and stop elevation angle for the blocking zone. If you enter nothing, there will be no blocking zone. Values allowed: -30 to 90 degrees.

Important You must enter 2 different elevation angles to have an active blocking zone.

5. Select **No TX** for zones ADUif you don't want the system to transmit.
   No check mark means that the system also works when pointing through areas with blocking objects. The VSAT modem will shut off for TX if no signal is received.

6. Click **Apply** to save the blocking zones.

6.3.5 Configuring the LAN network

The ACU has four 10/100 Mbit Ethernet ports labelled LAN port 1, 2, 3 and 4. The ports are divided in three groups, each operating in its own network.

To configure the LAN network go to **SETTINGS > Network.**

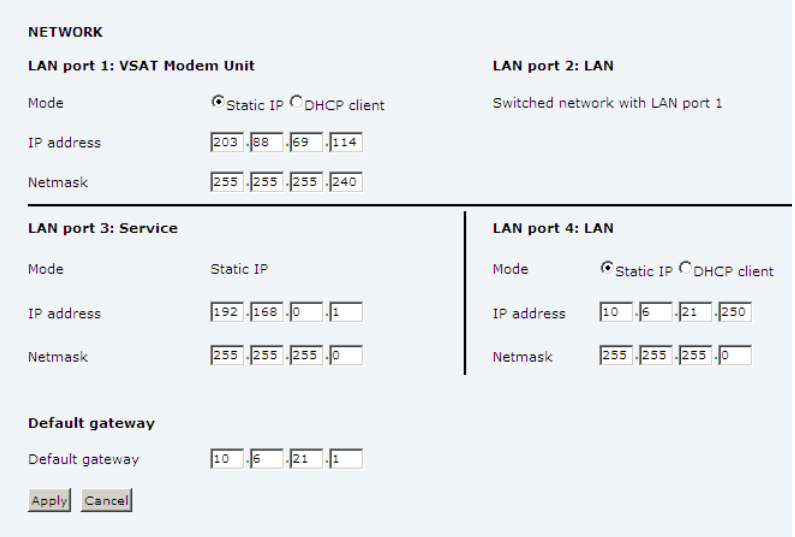


Figure 6-17: Web interface: SETTINGS, Network (LAN connectors)

Important Make sure that the 3 networks do not use IP address ranges that overlap.

LAN	Preferred use
1 + 2	LAN port 1 and 2 are switched, i.e. they share the same IP address and operate on the same network. This network is usually connected to the VSAT Modem Unit. **For OpenAMIP IP modem:** Make sure that you have entered this IP address also for the VSAT modem profile of the OpenAMIP modem, see *VSAT modem profile – New entry and Edit* on page 6-17.

Table 6-5: LAN port - preferred use

LAN	Preferred use
3	LAN port 3 is dedicated as the service port. By default this port has the IP address 192.168.0.1; the current value can be displayed in the ACU display and on the **DASHBOARD, Management IP address**. In a 19" rack mount it is recommended to connect LAN port 3 to the front port (via rear connector, see the figure *ACU rack version, connector panel overview* on page 4-2), for access to the service port from the rack front.
4	LAN port 4 can be used for connection to the LAN of the vessel or other general purpose.

Table 6-5: LAN port - preferred use

Static IP or DHCP Client

If you select **DHCP client**, the network IP address and sub-net mask must be provided by a DHCP server on that network. If the DHCP server also provides the address of a default gateway, set the default gateway in the web interface to 0.0.0.0.

If you select **Static IP** address you must specify a unique IP address and a sub-net mask.

Default Gateway

If the ACU needs to communicate with network units outside the specified sub-nets, you must specify a default gateway (typically a router). To remove the default gateway set it to 0.0.0.0.

6.3.6 E-mail setup

To be able to send diagnostics and statistics reports using e-mail you must set up the parameters shown on the screen below. Contact your IT department for the specific data

To configure the e-mail setup, do the following:

1. Go to **SETTINGS > E-mail setup.**

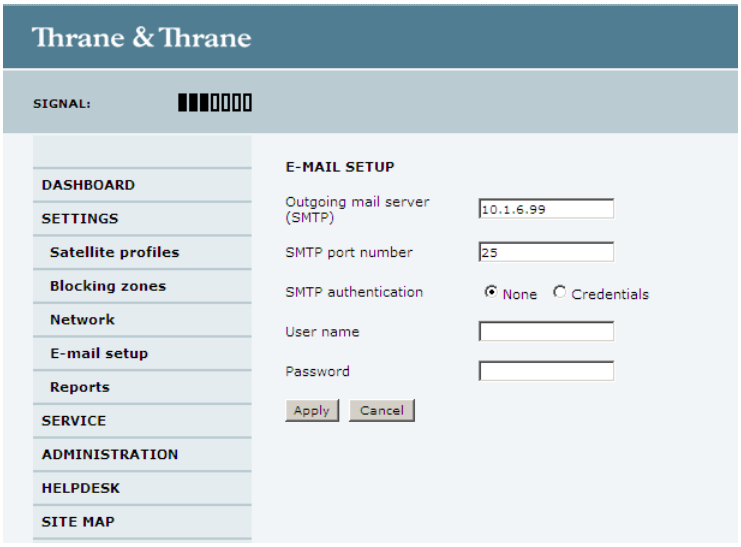


Figure 6-18: Web interface: SETTINGS, E-mail setup

2. Enter the data for Outgoing mail server (SMTP), SMTP port number, SMTP authentication, User name and password. This data is typically provided by your IT department.

6.3.7 Sending statistics reports

SAILOR 900 VSAT can send a statistics report at fixed intervals. This report contains historical information from the SAILOR 900 VSAT of up to 1 month. It is sent as a zipped attachment to an e-mail. The file format is a comma separated text file. The report can then be processed in spreadsheet applications, e.g. Microsoft Excel.

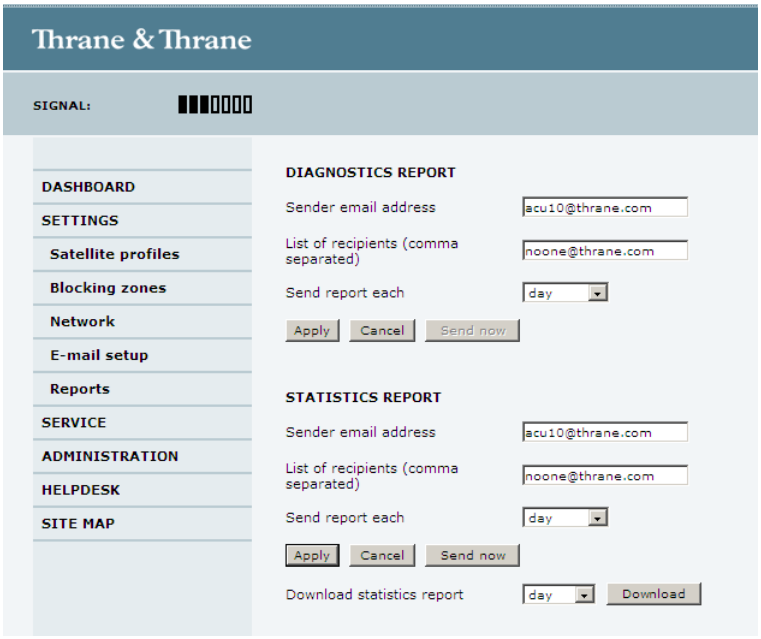


Figure 6-19: Web interface: SETTINGS, Reports (example)

To set up sending a statistics report, do as follows:

1. Go to **SETTINGS > Reports**.
2. In the section **STATISTICS REPORT** enter the following:
   - SMTP server.
   - Sender e-mail address, this address will be the e-mail address from sending the report.
   - List of recipients (comma separated).
   - Send the report each: Select disabled, day (default) with 2-minute samples, week with hourly samples or month with hourly samples. The report contains statistics data for the selected.
3. Click **Apply.**

   You can also send the report at any time by clicking **Send now** or download it directly to your computer by clicking **Download**. You can select statistics for the day, week or month.

The following parameters are recorded in the statistics report:

Parameter recorded	Description
UTC. (s) UTC (YYYY-MM-DD hh:mm)	UTC in seconds and date format for the data set.
RSSI.Av RSSI.Max RSSI.Min	Received signal strength (average, maximum and minimum value) for the sampling interval
POS.Lat (degree) POS.Long (degree) POS.Valid	Latitude value of position Longitude value of position Fix = valid position, No Fix = invalid position
Heading.Samp (degree) Heading.Max (degree) Heading.Min (degree) Heading.Range (+/-degree)	Ship's heading (sample, maximum and minimum value, range) for the sampling interval. See Figure 6-20: *Statistics – how to read data for a range*.
Antenna.Azi (degree) Antenna.Azi Max (degree) Antenna.Azi Min (degree) Antenna.Azi Range (+/-degree)	Current antenna azimuth (sample, maximum and minimum value, range) for the sampling interval. See Figure 6-20: *Statistics – how to read data for a range*.
Antenna.Ele (+/-degree) Antenna.Ele Max (+/-degree) Antenna.Ele Min (+/-degree)	Current antenna elevation (sample, maximum and minimum value) for the sampling interval.
Vsat.rx_lo_freq (GHz) Vsat.tx_lo_freq (GHz)	Rx frequency of VSAT modem for this record Tx frequency of VSAT modem for this record
Tracking.rf freq (GHz) Tracking.type	Tracking RF frequency for this record Narrow filter, DVB-S2 decoder and VSAT modem RSSI.
Sat.long (degree)	
Carrier rf.rx (GHz) Carrier rf.tx (GHz)	Rx frequency of carrier for this record Tx frequency of carrier for this record
Rx Lock (%) Logon (%)	Rx locked and logon time, in percent, for the sampling interval

Table 6-6: Parameters recorded in a statistics report

Parameter recorded	Description
Pos Ok (%)	Valid position, in percent of the 2 minute interval
VMU Connection (%)	No link with VSAT modem, in percent of the 2 minute interval
Blocking (%)	Ship in blocking zone, in percent of the 2 minute interval

Table 6-6: Parameters recorded in a statistics report (Continued)

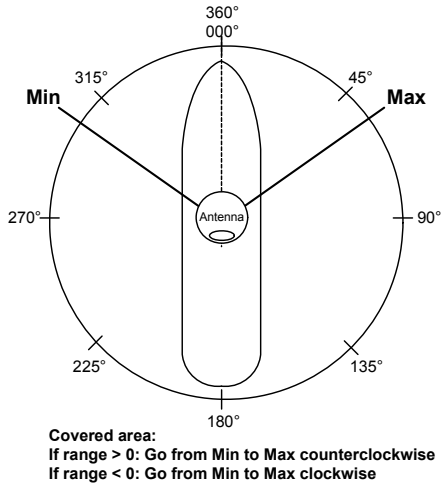


Figure 6-20: Statistics – how to read data for a range

Processing the statistics report in a spreadsheet application

The statistics report is in a data format that can be imported into spreadsheet applications, e.g. Microsoft Excel, for further processing.

1. Save the zipped file to your computer and extract the text file. The file name contains the identification of the system (example: adu-acu3_stat_20111021110901_day csv..txt).
2. Open the spreadsheet application, for example Microsoft Excel. On the tab Data click the tab Import from text. Import the unzipped text file and follow the instructions in the wizard. When asked about the delimiter, select ‘comma’.

The following figure shows an example of a statistics report in MS Excel 2007.

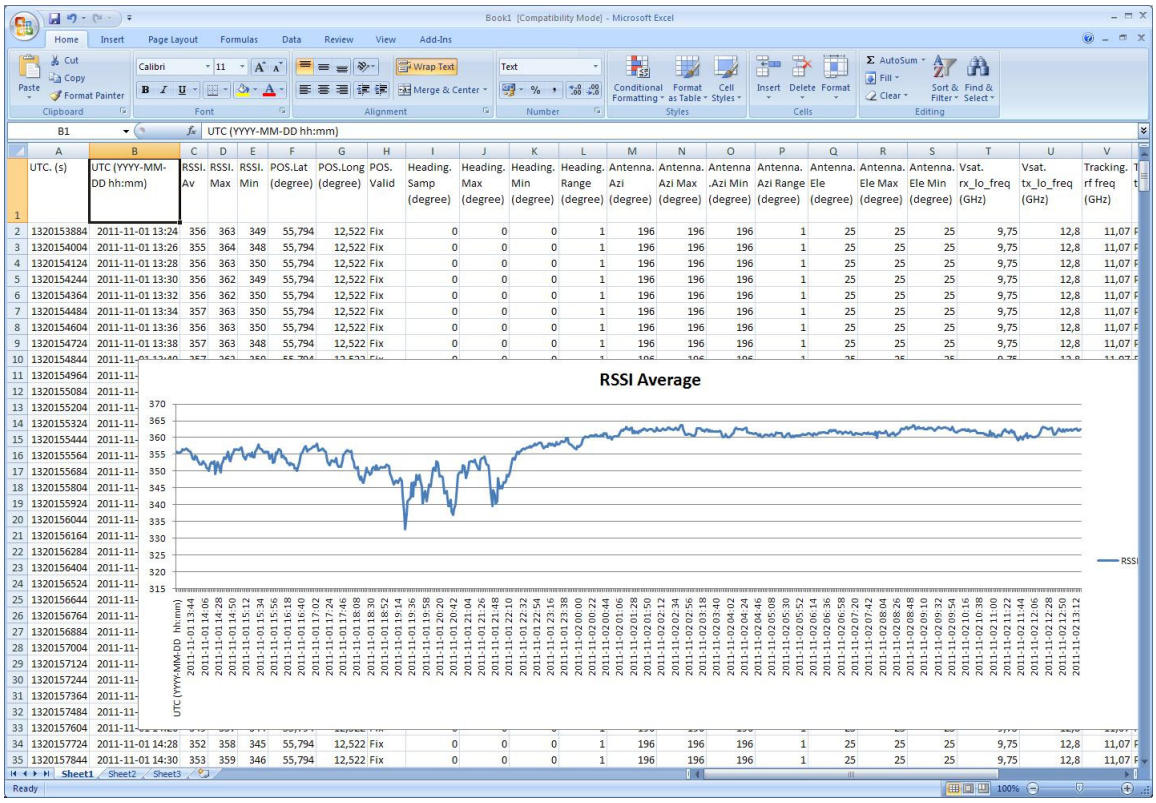


Figure 6-21: Statistics report (example)

6.3.8 Sending a diagnostic report

You can send automatically generated diagnostic reports at fixed intervals. The diagnostic report contains information relevant for the service personnel during troubleshooting.

To set up sending a statistics report, do as follows:

1. Go to **SETTINGS > Reports**.
2. In the section **DIAGNOSTICS REPORT** enter the following:
   - Sender e-mail address, this address will be the e-mail address from sending the report.
   - List of recipients (comma separated).
   - Send the report each: Select disabled, day (default), week or month. The report contains events and notifications of the selected period.
3. Click **Apply.**

If you want to generate a diagnostic report here and now click **Send now** or go to the page **HELPDESK** and click **Generate report** to download it directly to your computer.

For further details see *Generating a diagnostic report* on page 9-2.

6.3.9 Upload

For uploading new software to the SAILOR 900 VSAT see *Software update* on page 9-4.

6.3.10 Administration

In this section of the web interface you can configure the following administrative settings:

- *Setting up user permissions*
- *Resetting to factory default*

Accessing the administration settings: Logging on

The Administration settings require an Administration user name and password. To log on as administrator, do as follows:

1. Select **ADMINISTRATION** from the left navigation pane.
2. Enter the Administration user name and password.
   The default user name is **admin** and the default password is **1234**.

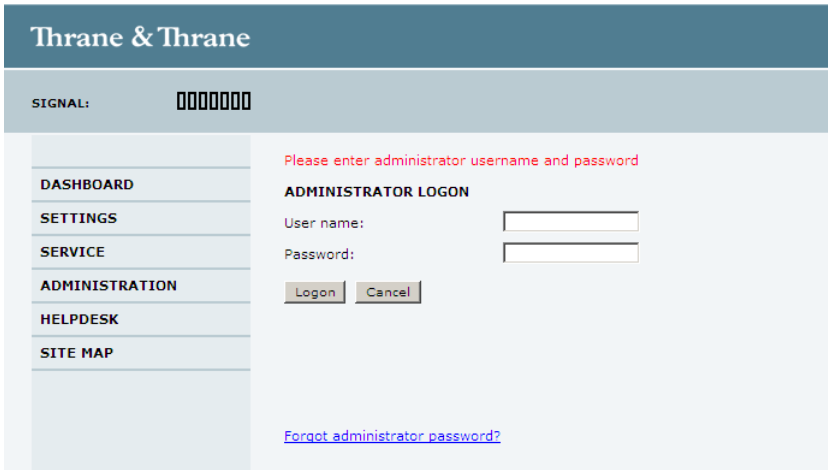


Figure 6-22: Web interface: Administration

If you have forgotten the administrator password, you can reset the password. For further information, see the next section *Resetting the administrator password*.

3. Click **Logon**.
   The Administration page is now updated to let you change the user name and password, Save/load a configuration or log off Administration.

Changing the administrator password

1. After entering the administrator user name and password in the **ADMINISTRATION** page, locate the section **Change administrator logon**.

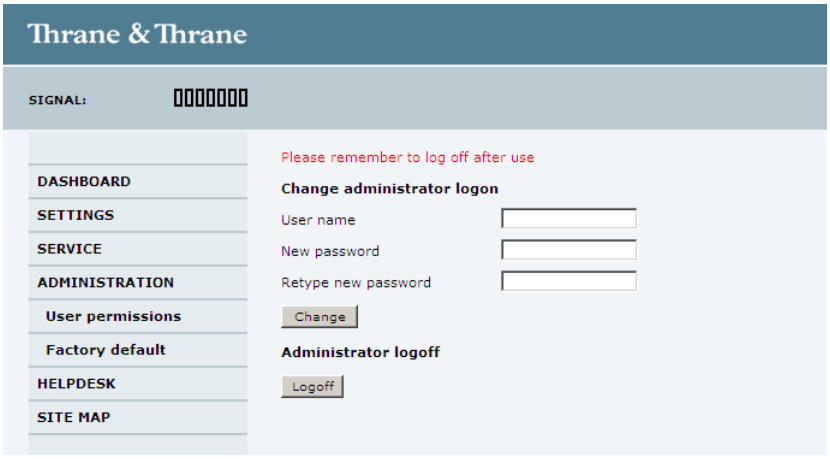


Figure 6-23: Web interface: Administration, change administrator logon

2. Type in the existing user name.
3. Type in the new password and retype it on the next line.
4. Click **Change**.

At the next logon the new password is required.

Resetting the administrator password

If you have forgotten and need to reset the administrator password, do as follows:

1. Contact your service partner for a reset code.
   Please report the serial number of the ACU. You find it in the **Dashboard, ACU serial number**.
2. Click the link **Forgot administrator password?** at the bottom of the **ADMINISTRATOR LOGON** page (see Figure 6-22: *Web interface: Administration*).

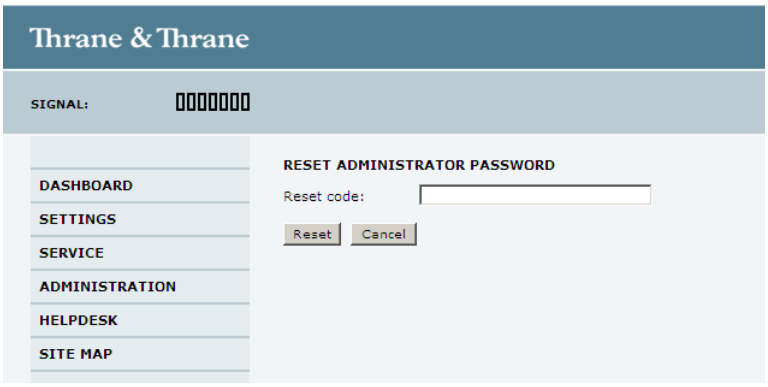


Figure 6-24: Web interface: ADMINISTRATION, Reset administrator password

3. Type in the reset code obtained from your service partner and click **Reset**.
4. Type in the user name **Admin** and the default password **1234**.
5. Click **Logon**.
   For information on how to change the password, see the section *Changing the administrator password* on page 6-29.

Logging off administration

If you have not entered anything for 30 minutes under **ADMINISTRATION**, you are logged off automatically. To log off manually, click **Logoff** under administrator logoff in the **ADMINISTRATION** page.

Setting up user permissions

You can manage user access to certain functions of the SAILOR 900 VSAT system. You can allow or deny users that are not administrators access to certain functions and make these pages read-only. This is useful if you want to protect the system against unintended changes or tampering of the system.

Important Study this screen thoroughly and decide which areas of the SAILOR 900 VSAT system you want to give non-administrator users access to.

To set up the user permissions, do as follows:

1. From the left navigation pane, select **ADMINISTRATION > User permissions**.

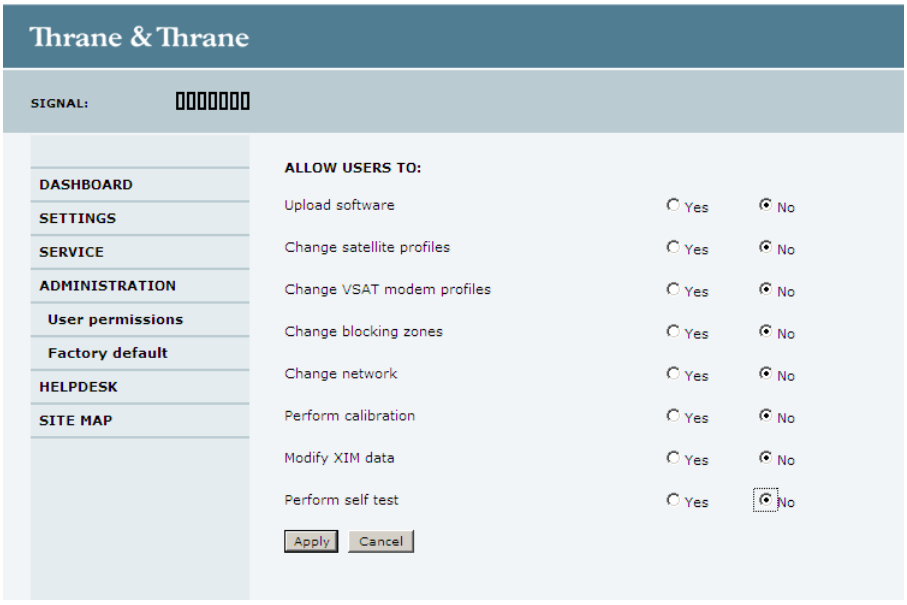


Figure 6-25: Web interface: ADMINISTRATION, User permissions

2. For each item under **ALLOW USERS TO:** select
   - **Yes** to allow access or
   - **No** to block access to the settings. Then the pages are read-only, changes cannot be made by non-administrator users.

   Change network: Change IP configuration of the LAN connectors. For further information see *Configuring the LAN network* on page 6-21.

   Modify XIM data: Only used during service and maintenance.

3. Click **Apply**.

   The settings to which access is denied are now greyed out for the non-administrator user.

Resetting to factory default

When resetting SAILOR 900 VSAT to factory default, the following settings are deleted:

- All satellite profiles
- All VSAT modem profiles
- Blocking zones
- Network setup
- User permissions
- ACU display: brightness setting

To reset to factory default settings, do as follows:

1. From the left navigation pane, select **ADMINISTRATION > Factory default**.

Figure 6-26: Web interface: ADMINISTRATION, Factory default

2. Click **Reset to factory default**.

6.4 Keypad of the SAILOR 900 VSAT ACU

6.4.1 ACU display and keypad

In the ACU display you can see the current state of the system. You can also see events (warnings, errors and information) and how the system has been configured. Use the keypad to navigate through the menu tree.

You can reset the system by pressing the up and down arrow keys simultaneously.

Figure 6-27: Display (example) and keypad of the ACU

Display text	Explanation
TRACKING	Current status of the SAILOR 900 VSAT. Examples: READY (Waiting for data from the VSAT modem or no satellite profile selected), ACQUISITION (Locating the satellite and acquiring the signal), TRACKING (Tracks the current satellite, operational TX BLOCKING ZONE (Antenna is pointing in a no TX zone) RX/TX BLOCKING ZONE (Antenna is pointing into a blocking zone, TX is off) SERVICE SWITCH (Service switch in ADU activated) SAFE MODE (Error, followed by an error description)
MAIN	Current menu. For all menus see *Antenna Control Unit, menu tree* on page 6-35.
TX:ON	The ADU is ready to transmit.
GPS:OK	A GPS signal is received from the GPS module.
HDG:OK	Ship heading data received from the ship's gyro.
LAN:1---	LAN connectors used. Example: LAN1 is used, LAN 2, 3 and 4 are not used

Table 6-7: Items in the ACU display (Example)

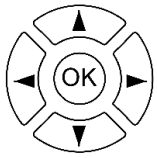
Display text	Explanation
SAT:151.2 W	Satellite position of currently active satellite profile. Example: 151.2° West.
RX:H	RX polarisation of currently active satellite profile. Example: Horizontal.
11.362/10.75	Rx RF frequency and LNB LO Frequency
TX:X	TX polarisation of currently active satellite profile. Example: Cross polarisation.

Table 6-7: Items in the ACU display (Example)

After 1 hour the display is dimmed to lowest intensity. Press any key to light up the display.

6.4.2 Navigating the menus

Use the keypad to navigate the menus.



- Press **OK** or ▶ to select a menu item.
- Use the arrow keys ▲ and ▼ to go through the menu items or enter a number, digit by digit.
- Use the arrow keys ◀ and ▶ to go through the settings and move from one digit to the next.
- Press **OK** to select a setting.
- Press ◀ again to move one level up. If applicable, confirm to store the new setting by pressing **OK**.

6.4.3 The menu tree

In the menu tree you can see how the system has been configured. You can also enter satellite information directly, if it is necessary to change the satellite information and you cannot use a connected PC and the web interface.

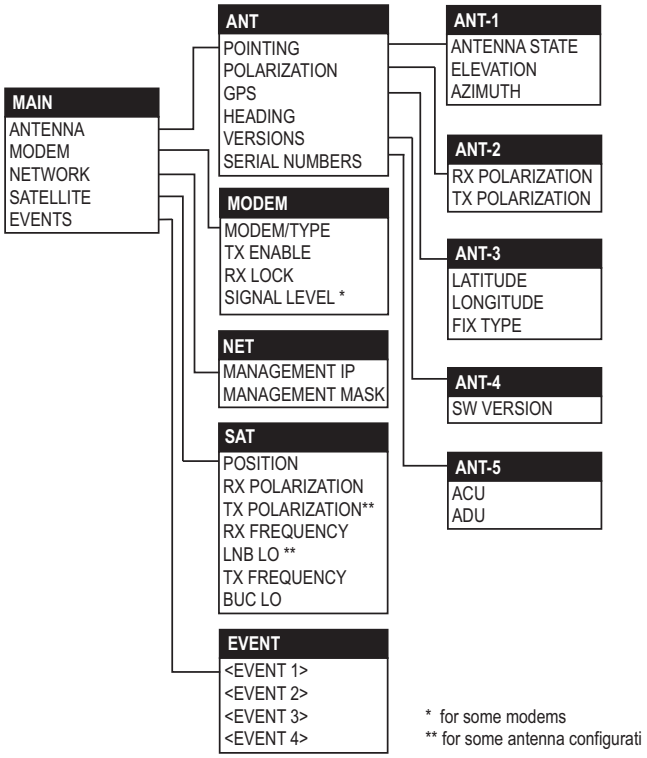


Figure 6-28: Antenna Control Unit, menu tree

Top-level menu

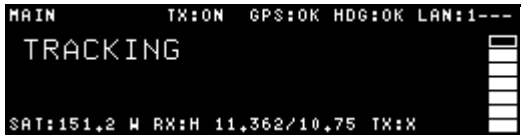
Top-level menu	Description
MAIN	View with current status of the SAILOR 900 VSAT. Example when logged on to the satellite:  This view is displayed after a time out of 10 minutes. Press any key (except left arrow) to enter the menu at **MAIN**. New events are shown in this display. If an event is displayed, press **OK** to jump directly to the menu **EVENTS** for viewing the currently active events.
ANTENNA	Shows the current ADU parameters, position, software version and serial numbers of the ADU and ACU.
MODEM	Selected VMU type and setup, including signal level.
NETWORK	Shows the IP address of the web interface of the ACU and the management mask. You need this IP address to access the web interface with a PC.
SATELLITE	Current satellite information. This information is entered using the web interface.
EVENTS	View system events. Active events are shown as: X ACTIVE EVENTS in the **MAIN** display. Press **OK** to update the list.

Table 6-8: Top-level menus of the ACU

Menu descriptions

ANTENNA menu	Description
POINTING	ANTENNA: READY (no satellite profile selected), ACQUISIITON (in the process of logging on), TRACKING (tracks the current satellite, operational) ELEVATION: Current elevation angle of the antenna AZIMUTH: Current azimuth of the antenna, with reference to North
POLARIZATION	RX POLARIZATION: HORIZONTAL or VERTICAL, read from connected VSAT modem. TX POLARIZATION: X-POL or P-POL, read from connected VSAT modem.
GPS	LATITUDE: current latitude, read from GPS module. LONGITUDE: current longitude, read from GPS module. FIX TYPE: 2D or 3D
HEADING	Ship's heading in degrees with reference to North, provided by the ship's gyro.
VERSIONS	Current software version.
SERIAL NUMBERS	ACU: Serial number of the below-deck unit ADU: Serial number of the antenna

Table 6-9: ANTENNA menu of the ACU

MODEM menu	Description
MODEM TYPE	Connected modem type.
TX ENABLE	On or off, information delivered by the connected VSAT modem.

Table 6-10: MODEM menu of the ACU

MODEM menu	Description
RX LOCK	On or off, information delivered by the connected VSAT modem.
SIGNAL LEVEL	Current input signal level from VSAT modem. iDirect openAMIP modem: (PWR) 0-500, delivered by the connected modem. For values <250 the antenna searches after a new signal. Other modem: Signal level in dB.

Table 6-10: MODEM menu of the ACU (Continued)

NETWORK menu	Description
MANAGEMENT IP	Current IP address of the SAILOR 900 VSAT web interface (default: 192.168.0.1).
MANAGEMENT MASK	Current netmask of the SAILOR 900 VSAT web interface (default: 255.255.255.0).

Table 6-11: NETWORK menu of the ACU

SATELLITE menu	Description
POSITION	Position of the active satellite
RX POLARIZATION	Horizontal or vertical (current satellite)
TX POLARIZATION	X-polarisation or Co-polarisation, auto-selected by VSAT modem
RX FREQUENCY	Ku band receiving frequency of the active satellite, auto-selected by VSAT modem
LNB LO	Auto selected by VSAT modem
TX FREQUENCY	Transmission frequency, auto-selected by VSAT modem
BUC LO	12.8 GHz, system parameter

Table 6-12: SATELLITE menu of the ACU

EVENT menu	Description
<EVENT>	In this menu all active events are listed. Use ▼ and ▲ to go through the active events. Events can be of the type WARNING or ERROR. For a list of events see *Event messages – overview* on page E-1. If a new event occurs or there is a change in the event list while you are in the **EVENTS** menu, a * is shown in the upper left corner of the display, next to the menu name. Press **OK** to update the EVENTS list, the * will be removed. A **>** means the event text is longer than the display. Press to **>** to see the remaining text.

Table 6-13: EVENTS menu of the ACU

Example: **EVENT 1/4***: This is the first event out of a list of 4 and there has been a change in the list. EVENT 1/4 will always be shown, the * indicates that there has been a change.

6.4.4 Adjusting brightness of the display

To adjust the brightness do the following:

1. Press and hold **OK** for a short moment until BRIGHTNESS XXX% is displayed (XXX is the current brightness value).
2. Hold OK pressed + press ▲ for lighter or ▼ for darker display.
3. Release OK to leave the brightness menu.

6.4.5 Resetting the system

To reset the system do the following:

1. Press and hold ▲ and ▼ until the ACU display shuts down and the ACU reboots.

Figure 6-29: Reset the system

2. Wait until the system has rebooted and is operational again. The last active satellite profile will be selected.

Installation check

Now that you have installed the system, you can test the system to verify it is ready for customer delivery. Follow the check lists below to test the system for proper operation.

- *Installation check list: Antenna*
- *Installation check list: ACU, connectors and wiring*
- *Installation check list: Functional test in harbor*

7.1 Installation check list: Antenna

Step	Task	Further information	Done
1.	Check that the antenna is free of obstructions.	See *Obstructions (ADU shadowing)* on page 3-3	
2.	Make sure there is sufficient space for access through the service hatch.	See *Installing the ADU* on page 3-19	
3.	Make sure to maintain the vertical orientation of the ADU center line.		
4.	Check that the ADU is installed where vibrations are limited to a minimum.		
5.	Check that you programmed the blocking zones correctly.	See *Blocking zones – azimuth and elevation* on page 3-5 and *Setting up Blocking zones (RX and TX)* on page 6-19	
6.	Make sure that the safety distance for radiation hazard of 30 metres is kept.	See *Safe access to the ADU: Radiation hazard* on page 3-6	

Table 7-1: Installation check list: Antenna

Step	Task	Further information	Done
7.	Check that the mounting height of the antenna is in accordance with the ship's min. roll period.	See *Ship motion and offset from the ship's motion centre* on page 3-7	
8.	Make sure that the requirements for mast foundation and height, including flatness, gusset plates and distance from welding seams are met.	See *ADU mast design: Foundation and height* on page 3-8	
9.	Make sure that the distances to radar, Inmarsat systems, GPS receivers and other transmitters are as required.	See *Interference* on page 3-13	
10.	Make sure that the drain tube is open and risk for water intrusion is at a minimum.	See *Other precautions* on page 3-17	
11.	Check that the ADU is grounded correctly, using the mounting bolts.	See *Grounding the ADU* on page 3-22 and *Grounding and RF protection* on page D-1	

Table 7-1: Installation check list: Antenna (Continued)

7.2 Installation check list: ACU, connectors and wiring

Step	Task	Further information	Done
1.	Check that the ACU is grounded correctly, using the mounting bolts and washers.	See *Grounding the ACU (bulkhead)* on page 3-24 or *Grounding the 19" rack version of the ACU* on page 3-27 and *Grounding and RF protection* on page D-1.	
2.	Make sure you strain relieved the cables.	See *Installation of the ACU (bulkhead)* on page 3-23 or *Installing the 19" rack version of the ACU* on page 3-26	
3.	Make sure that the VSAT modem is mounted close to the ACU.	See *General mounting considerations – VMU* on page 3-28.	
4.	Check that the ADU antenna N-connector is properly connected with the 50 ohm RF cable.	Visual inspection of the cover plate at the bottom of the ADU.	
5.	Check that the ACU antenna N-connector is properly connected with the 50 ohm RF cable.	Visual inspection of the connector panel of the ACU.	
6.	Check that the ACU's **Rx Out** is connected to the VSAT modem's Rx in using the included 1 m F-F 75 ohm cable.	Visual inspection of the connector panel of the ACU and the VSAT modem.	
7.	Check that the ACU's **Tx In** is connected to the VSAT modem's Tx out using the included 1 m F-F 75 ohm cable.	Visual inspection of the connector panel of the ACU and the VSAT modem.	

Table 7-2: Installation check list: ACU, connectors and wiring

Step	Task	Further information	Done
8.	Check connection of the VSAT modem: **COMTECH only!:** Check that the ACU RS-232 port is connected to the Remote Control port of the VMU using the included serial cable. **iDirect iNFINITI 5000 Series/ Evolution X5 only!:** Check that the ACU RS-232 port is connected to the Console port of the VMU using the included serial cable. **iDirect iNFINITY 5000 Series only!:** Check that the ACU LAN port 1 is connected to the LAN B of the VMU using the included CAT5 Ethernet cable. **iDirect Evolution X5 only!:** Check that the ACU LAN port 1 is connected to the LAN of the VMU using the included CAT5 Ethernet cable.	Visual inspection of the connector panel of the ACU and the VSAT modem.	
9.	Check that the ADU's NMEA 0183 connector is connected to the NMEA 0183 bus of the vessel using the included multi-connector	Visual inspection of the connector panel of the ACU connector.	
10.	Measure that the power has the correct polarity in the power connector, before connecting it to the ACU power input.	Use a volt meter. See Table 4-1: *DC Input plug, outline and pin assignment* on page 4-3.	

Table 7-2: Installation check list: ACU, connectors and wiring (Continued)

7.3 Installation check list: Functional test in harbor

Step	Task	Further information	Done
1	Check that the antenna is locked to the satellite	The logon LED in the ACU display must be steady green and the display shows: **TRACKING**. In the web interface check: DASHBOARD: System status: Tracking	
2	Check that the VMU is in lock and ready for Tx.	In the web interface check: DASHBOARD > VSAT MODEM > Signal level and RX frequency show values.	
3	Connect a user PC LAN (not the service PC) to the Internet LAN connector, either on the LAN port 2 of the ACU (only X5 VSAT modem) or to the User LAN connector on the VMU.	Check the VSAT modem documentation for details.	
4	Open a DOS window and type: ping 4.2.2.2.	Check that you get a response.	
5	Open a web browser and browse to www.google.com.	Check that the web page is downloaded.	
6	If step 4 is successful and step 5 is not then it seems like the DNS is not configured correctly.	Check with the VSAT modem documentation how the DNS server must be set up, “Obtain DNS server address automatically” or enter specific DNS server addresses.	

Table 7-3: Installation check list: Functional test in harbor

Daily use – Quick guide

QUICK GUIDE

SAILOR 900 VSAT

Introduction
The SAILOR 900 VSAT system has been configured during installation with all needed satellite and modem profiles. After startup it uses the last selected satellite profile.

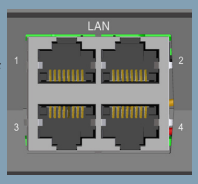
To change to another satellite (or modem profile), or change an antenna parameter, connect a PC to the Antenna Control Unit (ACU) and enter the built-in web interface.

Setup and configuration
Set up your PC network connection to use a static IP address:

- IP address: 192.168.0.2
- Subnet mask: 255.255.255.0
- Gateway: 192.168.0.1

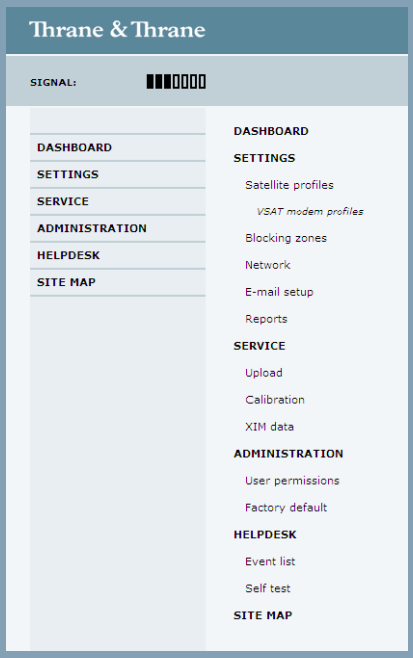
Switch on the SAILOR 900 VSAT at the power switch of the ACU.

Connect a PC to LAN port 3 (Rack version: Front LAN connector) of the ACU, use a straight Ethernet cable.



Enter the address **http://192.168.0.1** (default) in your Internet browser. The built-in web interface opens directly with the **DASHBOARD**.

Click **SETTINGS** and activate the new satellite profile.



For detailed information about the SAILOR 900 VSAT system see the **SAILOR 900 VSAT Installation & user manual**.

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Figure 8-1: SAILOR 900 VSAT Quick Guide – web interface and satellite profiles

SAILOR 900 VSAT

Viewing system parameters

Introduction
Use the arrow keys of the Antenna Control Unit (ACU) for navigation. See the menu tree for an overview of the parameters available.

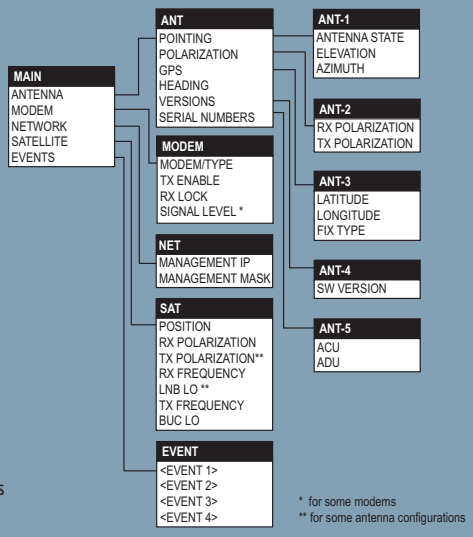
Navigation
Switch on the SAILOR 900 VSAT at the power switch of the ACU.

Use the arrow keys on the keypad to go to a menu.

Press **OK**, then the arrow keys on the keypad to select a parameter.

The current menu name is shown in the upper left corner of the display.

For changing a parameter in the SAILOR 900 VSAT use the built-in web interface of the ACU. See overleaf for a short introduction.



Resetting the ACU
Press and hold the arrow up and down keys until the ACU display shuts down and the ACU reboots.

Wait until the system has rebooted and is operational again. The last active satellite profile will be selected.

For more detailed information about the SAILOR 900 VSAT system see the **SAILOR 900 VSAT Installation & user manual**.

98-133401-B

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Figure 8-2: SAILOR 900 VSAT Quick Guide – Viewing system parameters

Service

In this chapter you find the following sections:

- *Getting support: Helpdesk*
- *Software update*
- *Status signalling with LEDs and status messages*
- *Removal and replacement of the ACU*
- *Removal and replacement of ADU modules*
- *Initial troubleshooting*

9.1 Getting support: Helpdesk

If this manual does not provide the remedies to solve your problem, contact your Airtime Provider.

9.1.1 Help desk and diagnostic report

Support at the Help desk

During the installation you must enter the support contact for this installation.

To access the Help desk, select **HELP DESK** from the left navigation pane.

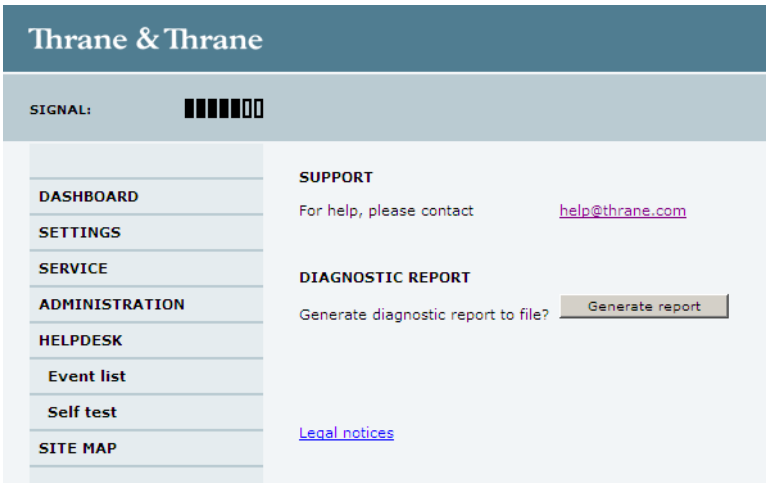

Figure 9-1: Web interface: HELPDESK

Click the link, enter support contact information and click **Apply**.

Figure 9-2: Web interface: HELPDESK, enter support contact

Clicking the link Legal notice provides licence text for the source code of the parts of SAILOR 900 VSAT software that falls under free and open source software.

If you need help **with ACU or ADU related issues** call your service provider.

Generating a diagnostic report

You can generate a diagnostic reports. The diagnostic report contains information relevant for the service personnel during troubleshooting.

To generate a diagnostic report click **Generate report**, then you can save it on your computer.

You can also configure the system to send diagnostic reports at defined time intervals. For further details on this see *Sending a diagnostic report* on page 6-27.

Event list

Use the event list when troubleshooting the installation, for further details see *Viewing the Event list* on page 9-15 and *System messages* on page E-1. Only active events are shown in the list. Once an event is cleared, it is not displayed any longer.

Self test

You can start a self test of the SAILOR 900 VSAT ADU and ACU.

1. Click **Self test** in the **HELP DESK** page.
2. Click the menu item **Self test**.

Important Warning! The SAILOR 900 VSAT will reboot to perform the self test. Rebooting the ACU will terminate all existing connections.

9.2 Software update

Hardware and software requirements

The following items are required before the software can be updated:

- One computer with a standard Ethernet port available.
- A standard Internet browser.
- 1024×768 pixels or higher display resolution. The program is best viewed using small fonts.
- One straight LAN cable.
- The file containing the new software.

9.2.1 Software update (ADU and ACU)

Note Software update should only be done by qualified service personnel.

1. Power up the SAILOR 900 VSAT system, i.e. switch on the ACU. Wait until the LEDs on the front plate of the ACU show that the system is ready to be configured.
   - Power LED: Green
   - Logon LED: Off
   - Fail/Pass LED: Flashing green, during power-on self test, after that steady green.
2. Set up your PC network connection to use a static IP address:
   - IP: 192.168.0.2
   - Subnet mask: 255.255.255.0
   - Gateway: 192.168.0.1

   For more detailed instructions and proxy server settings see *Overview and navigation* on page 6-8.
3. Connect a PC to LAN interface 3 (Service port, standard Ethernet) of the ACU. For the rack version connect the LAN cable to the front LAN connector of the ACU.

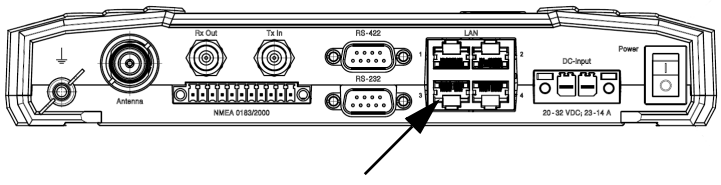

Figure 9-3: LAN connector used for configuring the SAILOR 900 VSAT

4. Open your Internet browser and enter the IP address of the ACU. The IP address is **http://192.168.0.1** (default).

5. The web interface opens directly with the **DASHBOARD** page.
6. Click **SERVICE** from the left navigation pane. The **Upload** page is displayed.

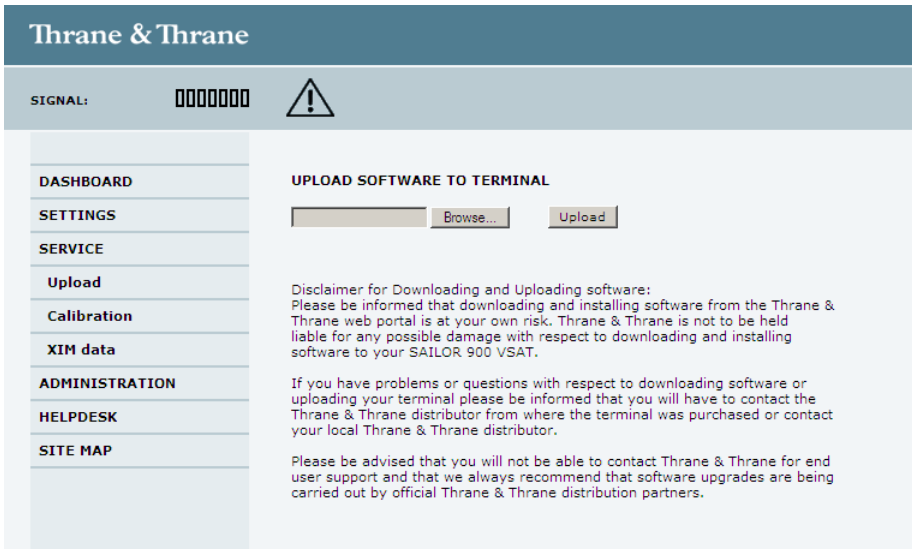

Figure 9-4: Web interface: SERVICE, Upload

7. The **Current software version** field shows the current software version.
8. In the section **UPLOAD SOFTWARE TO TERMINAL** Click **Browse...** and locate the new software file.
9. Click **Upload**.
   Note that the upload procedure takes a couple of minutes. When done, the ACU automatically restarts with the new software version.
   The start-up procedure after a software upload takes longer than the usual start-up time, as the software in the ADU must also be updated. The ACU display shows: **ADU SW UPLOAD**.

If software upload fails - how to recover

To recover from a failed software upload, turn off the ACU and turn it on again. Then repeat the upload procedure as described in *Software update* on page 9-4.

9.2.2 Verifying the software update

Testing procedure

1. The software version can be viewed in the **DASHBOARD** window of the web interface.
2. After completing the software update procedure, the ACU will perform a POST (Power On Self Test).

3. When the POST has finished, the green Pass/Fail LED on the front of the ACU must become steadily green. Verify that the Pass/Fail LED is not red nor flashing orange once every 2 seconds. Wait until the Pass/Fail LED is green.
4. Verify that the software update has been completed successfully. You find the software version number in the **DASHBOARD** window of the web interface.

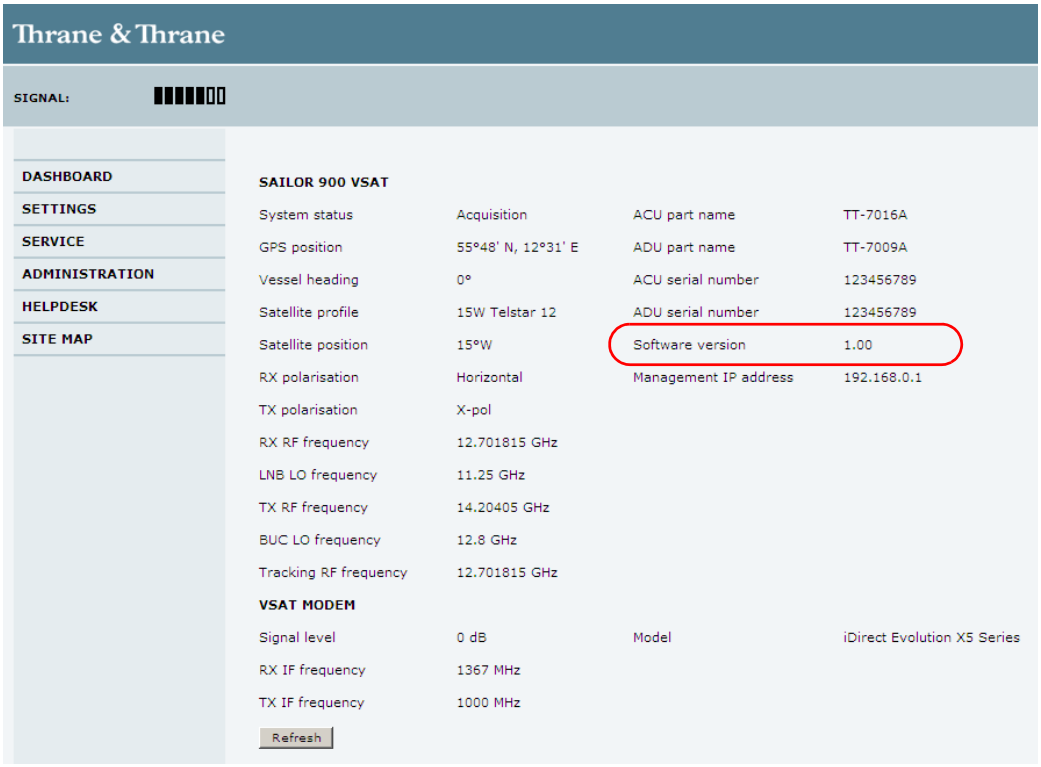

Figure 9-5: Verifying software update

9.3 Status signalling with LEDs and status messages

Built-In Test Equipment

The ADU and the ACU have a Built-In Test Equipment (BITE) function in order to make fault diagnostics easy during service and installation.

The BITE test is performed during:

- Power On Self Test (POST), which is automatically performed each time the system is powered on.
- Person Activated Self Test (PAST), which is initiated by starting a self test in the web interface **HELPDESK > Self test**.

Details on error messages after a POST or a self test can be found in the event list of the ACU, see *Viewing the Event list* on page 9-15.

Means of signalling

The SAILOR 900 VSAT system provides various methods for signalling the status of the system.

- **LEDs** on the front panel of the ACU are used to signal:
  - Power on/off
  - Logon
  - Fail/Pass
- The built-in web interface of the ACU shows any events (BITE error codes) with a short message describing each error. This is also displayed in the ACU.

In case of an error situation, one of the following system status messages may be shown:

- ACU POST error
- ADU POST error
- SAFE MODE (plus information about the specific error, see *System messages* on page E-1).

9.3.1 LEDs of the ADU modules

Each ADU module has a Power and a Service LED.

LED	Behavior	Description
Power	Steady green	Power supply OK
	Off	No power
Service	Steady green	Module ok, application running.
	Flashing green	Waiting for upload
	Flashing red/green	Uploading application
	Steady red	Module error or loading error

Table 9-1: LEDs of the ADU modules

For a list of modules see *Removal and replacement of ADU modules* on page 9-12.

9.3.2 LEDs in the ACU

The ACU has 3 LEDs: Power, Logon and Fail/Pass LED.

Figure 9-6: LEDs on the ACU

Figure 9-7: LEDs on the ACU, 19" rack version

LED	Behavior	Description
Power	Steady green	Power supply OK
	Steady red	Power supply failure
	Off	No power
Logon	Flashing green	Current status is displayed: • Searching satellite • Identifying satellite • Carrier lock & TX enabled from modem
	Steady green	Satellite link established
	Off	No satellite link acquired

Table 9-2: LEDs on the ACU

LED	Behavior	Description
Fail/Pass LED	Steady red	A fault which prevents operation is present in the system (ACU, ADU, MODEM).
	Flashing green	A Power On Self Test (POST) or Person Activated Test (PAST) in progress. The current status is displayed.
	Flashing red	Active BITE failure or warning. The event is shown in the ACU display.
	Steady green	No faults.

Table 9-2: LEDs on the ACU (Continued)

9.4 Removal and replacement of the ACU

There are no parts in the ACU that you can remove or replace. If the ACU malfunctions, remove it from the wall, desk or rack and contact your Thrane & Thrane service partner for further repair or replacement.

Figure 9-8: Removal and replacement of the ACU bulkhead

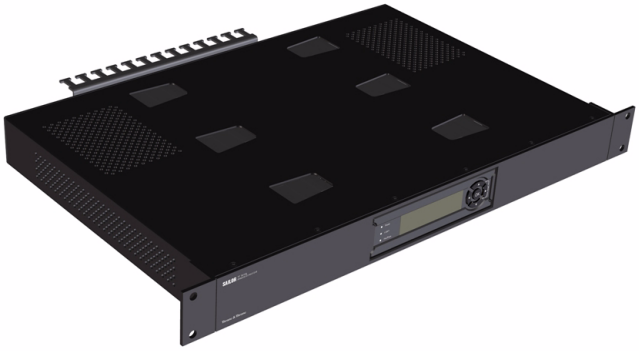

Figure 9-9: Removal and replacement of the ACU 19" rack

9.5 Removal and replacement of ADU modules

For replacement of a module contact your Thrane & Thrane service partner. The figure below shows the modules and their position. Some modules are equipped with LEDs for status information and troubleshooting.

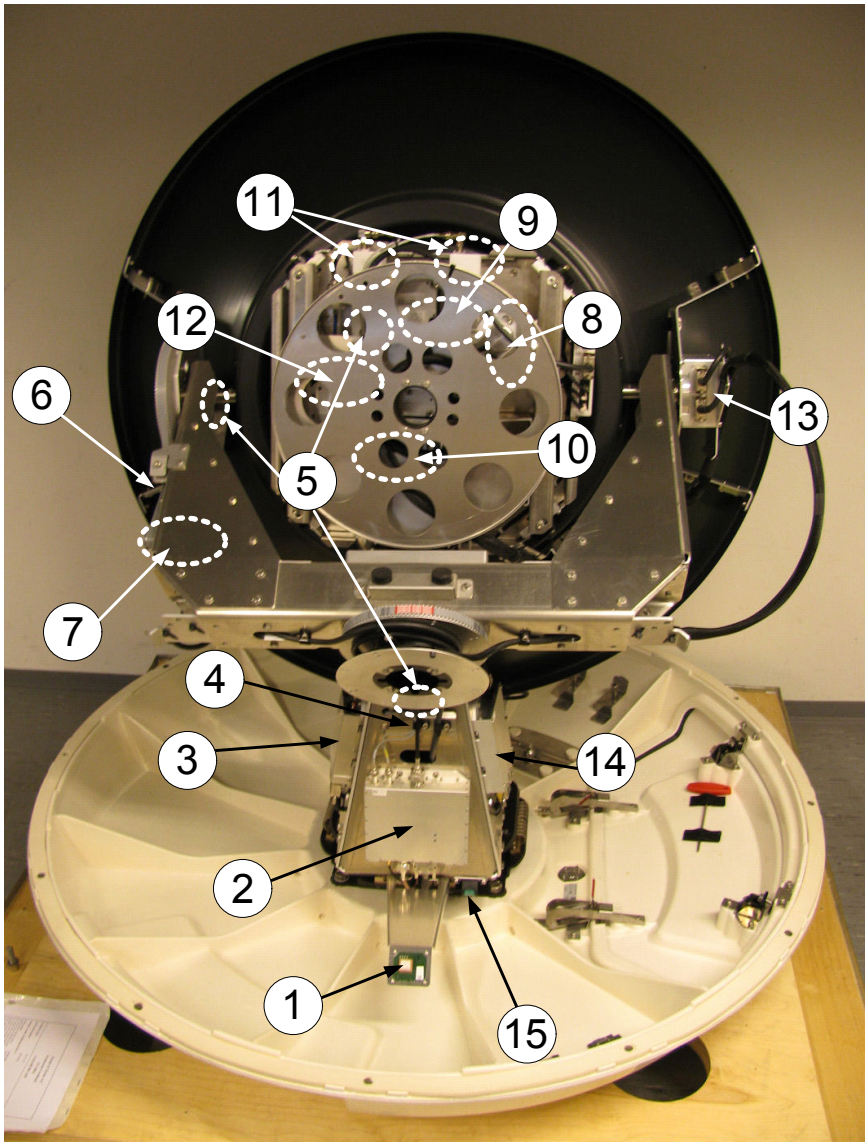

Figure 9-10: ADU modules and motor stop switch

1. GPS module.
2. VSAT Interface Module (VIM).
3. DC-Motor Driver Module for cross elevation (DDM).
4. Cross elevation motor and encoder.
5. Zero Reference Module (x4) (ZRM). (not visible on photo)

6. DC-Motor Driver Module for elevation (on the side).
7. Elevation motor and encoder. (not visible on photo)
8. Polarisation Motor Module (PMM). (not visible on photo)
9. Polarisation motor and encoder. (not visible on photo)
10. Block Up Converter (BUC). (behind cable screen, not visible on photo)
11. Low Noise Block downconverter (x2) (LNB). (not visible on photo)
12. Ortho Mode Transducer (OMT). (not visible on photo)
13. Inertial Sensor Module (ISM).
14. Pedestal Control Module (PCM).
15. Service switch.
    In switch-off position the DC Motor Driver modules and the BUC are turned off for safe conditions during service and repair. The switch must be in on position for normal ADU operation.

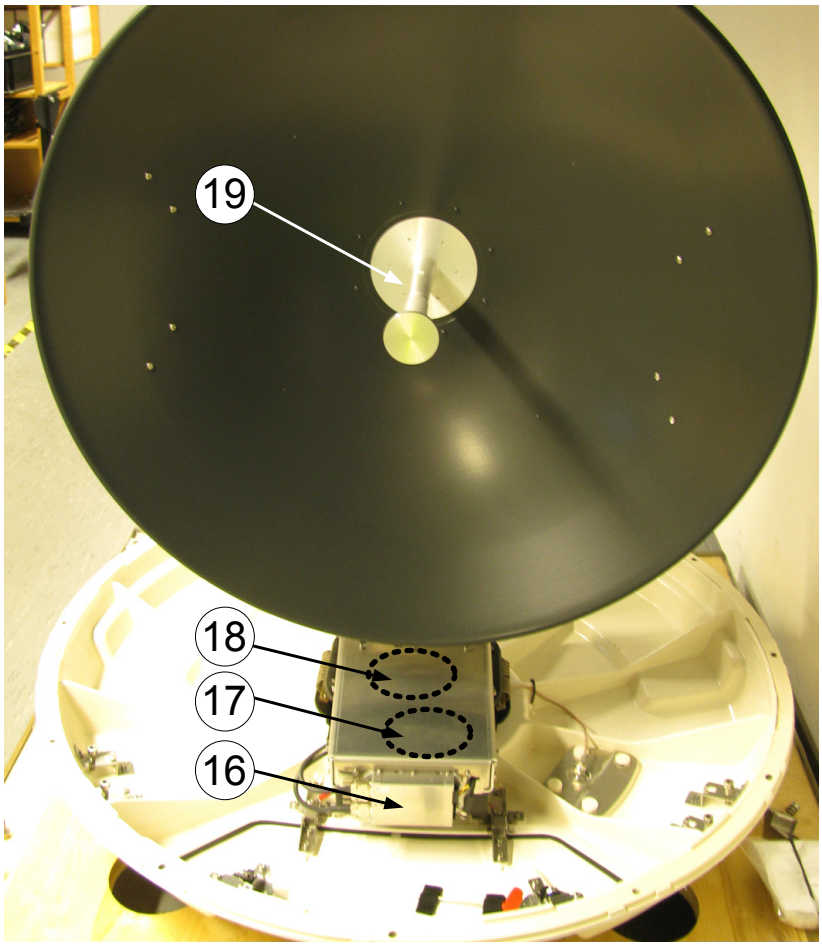

Figure 9-11: Above Deck Unit modules (continued)

16. DC-Motor Driver Module for Azimuth.

17. Azimuth motor and encoder. (not visible on photo)

18. Rotary joint. (not visible on photo)

19. Feed horn.

Before contacting your service partner check the LEDs on each module. See *LEDs of the ADU modules* on page 9-8 and *LEDs in the ACU* on page 9-9.

9.6 Initial troubleshooting

Overview

This section describes an initial check of the primary functions of the SAILOR 900 VSAT system, and provides some guidelines for troubleshooting, if one of the checks should fail.

Generally, if a fault occurs without any obvious reason, it is always recommended to observe the LEDs and the ACU display showing the active events.

For information on the function of the LEDs, see *Status signalling with LEDs and status messages* on page 9-7.

For a list of all the error messages and warnings, see *Event messages – overview* on page E-1.

Possible failure states are shown in the web interface and the display of the ACU:

- SAFE MODE (error in unit)
- ADU POST error (hardware error)
- ACU POST error (hardware error)

9.6.1 Viewing the Event list

When an event is registered, the web interface shows an event icon ⚠ in the icon bar as long as the event is active. The ACU display shows also active events.

The **Event list** in the web interface shows a list of events that are currently active.

Event list

To view the event list, click the event icon from the icon bar at the top of the web interface, or select **HELPDESK > Event list** from the left navigation pane.

The **Event list** page shows a detailed list of active events and notifications including the time of the first occurrence, ID and severity of the event message, and a short text describing the error. Active events are cleared when the error is cleared. Notifications are cleared automatically after 24 hours and after restart of the system.

For a list of events with description, error code (ID), explanation and remedy see *List of events with explanation and remedy* on page C-1.

You cannot download the event list, but you can generate a diagnostic report containing results from the POST, all events and system log information since the last reset to factory default. For more information see *Sending a diagnostic report* on page 6-27.

Appendices

Technical specifications

A.1 SAILOR 900 VSAT system components

A.1.1 General specifications

Item	Specification
Frequency band	Ku-band (VSAT)
Rx	10.70 to 12.75 GHz
Tx	13.75 to 14.50 GHz (extended)
Reflector size	103 cm (40 inch)
Certification (approval)	Compliant with CE (Maritime), ETSI EN 302 340, CEI/IEC 60950-1, CEI/IEC 60945, CEI/IEC 60950-22
ADU cable type (ACU to ADU)	Single 50 Ohm coax cable for Rx, Tx, ACU-ADU modem and power
ADU cable connector at the ADU	Female N-Connector (50 Ohm)
ADU cable connector at the ACU	Female N-Connector (50 Ohm)
System power supply range	20–32 VDC (Start up voltage: 22 VDC guaranteed)
Total system power consumption	370 W peak, 175 W typical (up to 8 W BUC)

Table A-1: General specifications

A.1.2 ADU

Item	Specification
Dimensions (overall)	Diameter x Height: Ø 130 cm (51.3 inch) x H 150 cm (58.9 inch)
Weight	135 kg (288 lbs)
Antenna type, pedestal	3-axis (plus skew) stabilised tracking ADU with integrated GPS
Antenna type, reflector system	Reflector/sub-reflector, ring focus
Transmit Gain	41.4 dBi typ. @ 14.25 GHz (excluding radome)
Receive Gain	40.1 dBi typ. @ 11.70 GHz (excluding radome)
System G/T	17.9 dB/K typ. @ 11.70 GHz, at ≥30° elevation and clear sky (including radome)
BUC output power	8 W
EIRP	≥ 49 dBW (including radome)
LNB	2 units 4-band LNBs (band selection by ACU)
Tracking Receiver	Internal "all band/modulation type" and VSAT modem RSSI
Polarisation	Linear Cross or Co-Pol (selected by ACU)
Elevation Range	-25° to +125°
Azimuth Range	Unlimited (Rotary Joint)
Ship motion, angular	Roll ±30°, Pitch ±15°, Yaw ±10°
Ship, turning rate and acceleration	15°/s and 15°/s^2
ADU motion, linear	Linear accelerations ±2.5 g max any direction

Table A-2: Technical specifications for the Above Deck Unit

Item	Specification
Satellite acquisition	Automatic - w. Gyro/GPS compass input
Vibration, operational	Sine: IEC 945 (8.7.2), DNV A, MIL-STD-167-1 (5.1.3.3.5). Random: Maritime
Vibration, survival	Sine: IEC 945 (8.7.2) dwell, MIL-STD-167-1 (5.1.3.3.5) dwell. Random: Maritime survival
Shock	MIL-STD-810F 516.5 (Proc. II)
Temperature (ambient)	Operational: -25° C to 55° C Storage: -40°C to 85°C
Humidity	100%, condensing
Rain (IP class)	IEC 945 Exposed (IPX6)
Wind resistance	Operational: 80 kt. Survial: 110 kt.
Ice	Survival: 25 mm (1 inch)
Solar radiation	1120 W/m2 to MIL-STD-810F 505.4
Compass safe distance	1 m to IEC 945
Maintenance, scheduled	None (T_{amb} > 10°C)
Maintenance, unscheduled	All electronic, electromechanical modules and belts can be replaced through the service hatch.
Built-in tests	Power On Self Test (POST) Person Activated Self Test (PAST) Continuous Monitoring (CM) with error log
Power OFF	Automatic safe mode

Table A-2: Technical specifications for the Above Deck Unit (Continued)

A.1.3 ACU

Item	Specification
Dimensions, rack mount H x W x D	1 U, 19 inch 4.4 x 48 x 33 cm (1.75 x 19 x 13 inch)
Dimensions, bulkhead mount H x W x D	stand-alone unit 4.3 x 25.5 x 27.8 cm (1.67 x 10.0 x 10.9 inch)
Weight, rack mount	4.5 kg (10 lbs)
Weight, bulkhead mount	2.7 kg (6 lbs)
Ambient temperature	Operational: -25°C to +55°C Storage: -40°C to +85°C
Humidity	IEC 945 protected, 95% (non-condensing)
IP class	IP31
Compass safe distance	1 m to IEC 945
Interfaces	1 x N-Connector for antenna RF Cable (50 Ohm) w. automatic cable loss compensation 2 x F-Connectors (75 Ohm) for Rx/Tx to VSAT modem 1 x Ethernet data (VSAT Modem Control) 1 x RS-422 data (VSAT Modem Control) 1 x RS-232 data (VSAT Modem Control) 1 x NMEA 2000 (CAN bus) and NMEA 0183 (RS-422) for Gyro/GPS compass input 2 x Ethernet (user) 1 x Ethernet (service, set-up etc.) 1 x DC power input 1 x Grounding bolt
Input power	See *System power supply range* and *Total system power consumption* on page A-1.

Table A-3: Technical specifications for the ACU

Item	Specification
Modem interface (control)	iDirect openAMIP protocol & custom protocol
Man Machine Interface (MMI)	OLED (red) display, 5 push buttons, 3 discrete indicator LEDs and ON/OFF switch
No transmit zones	Programmable

Table A-3: Technical specifications for the ACU (Continued)

A.1.4 Supported VSAT modems

Item	Specification
Modems supported	For a list of supported VSAT modems see the SAILOR 900 VSAT data sheet.

Table A-4: Supported VSAT modems

A.2 Outline drawings

A.2.1 ADU

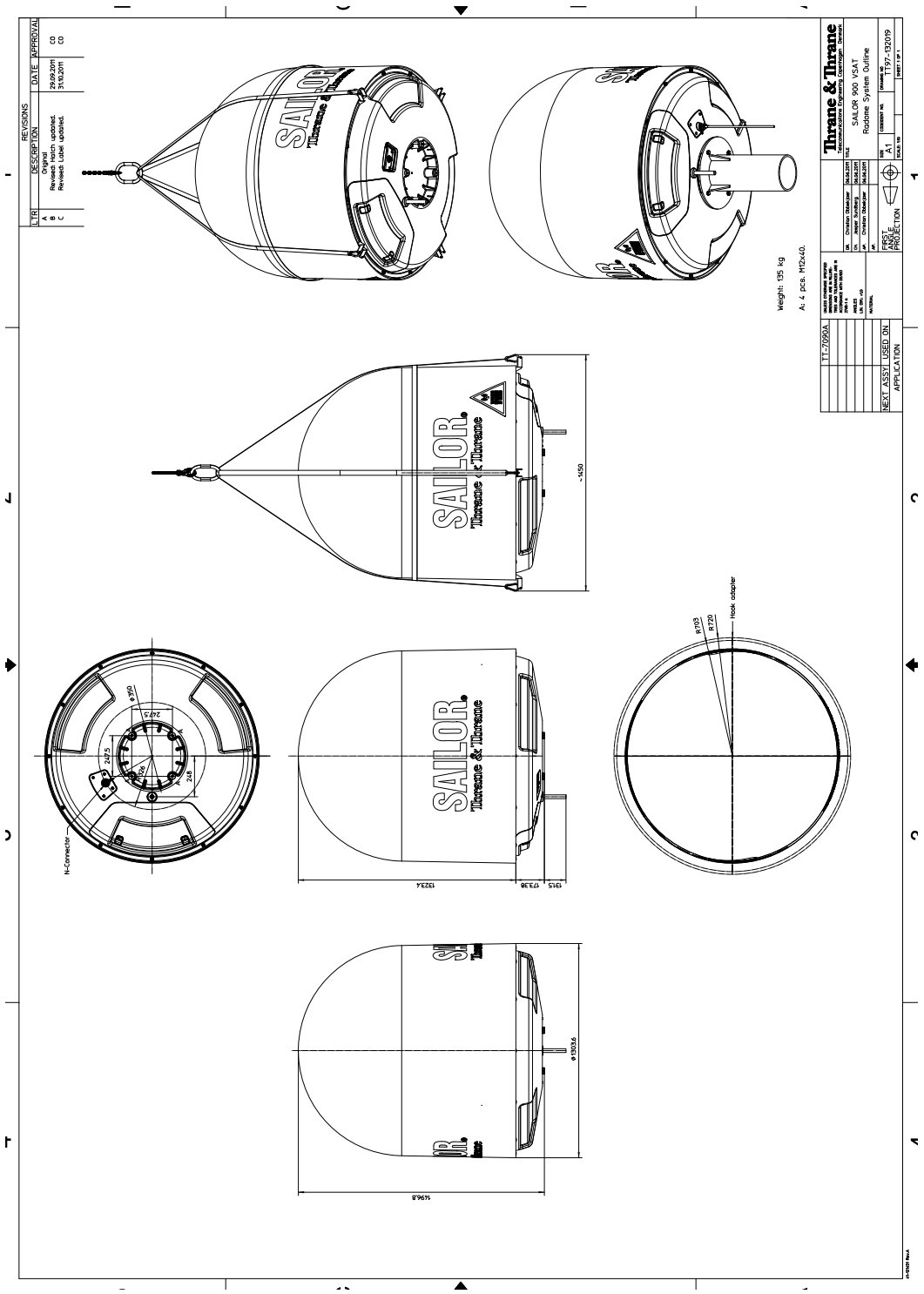

Figure A-1: Outline drawing: ADU

A.2.2 ACU, bulkhead

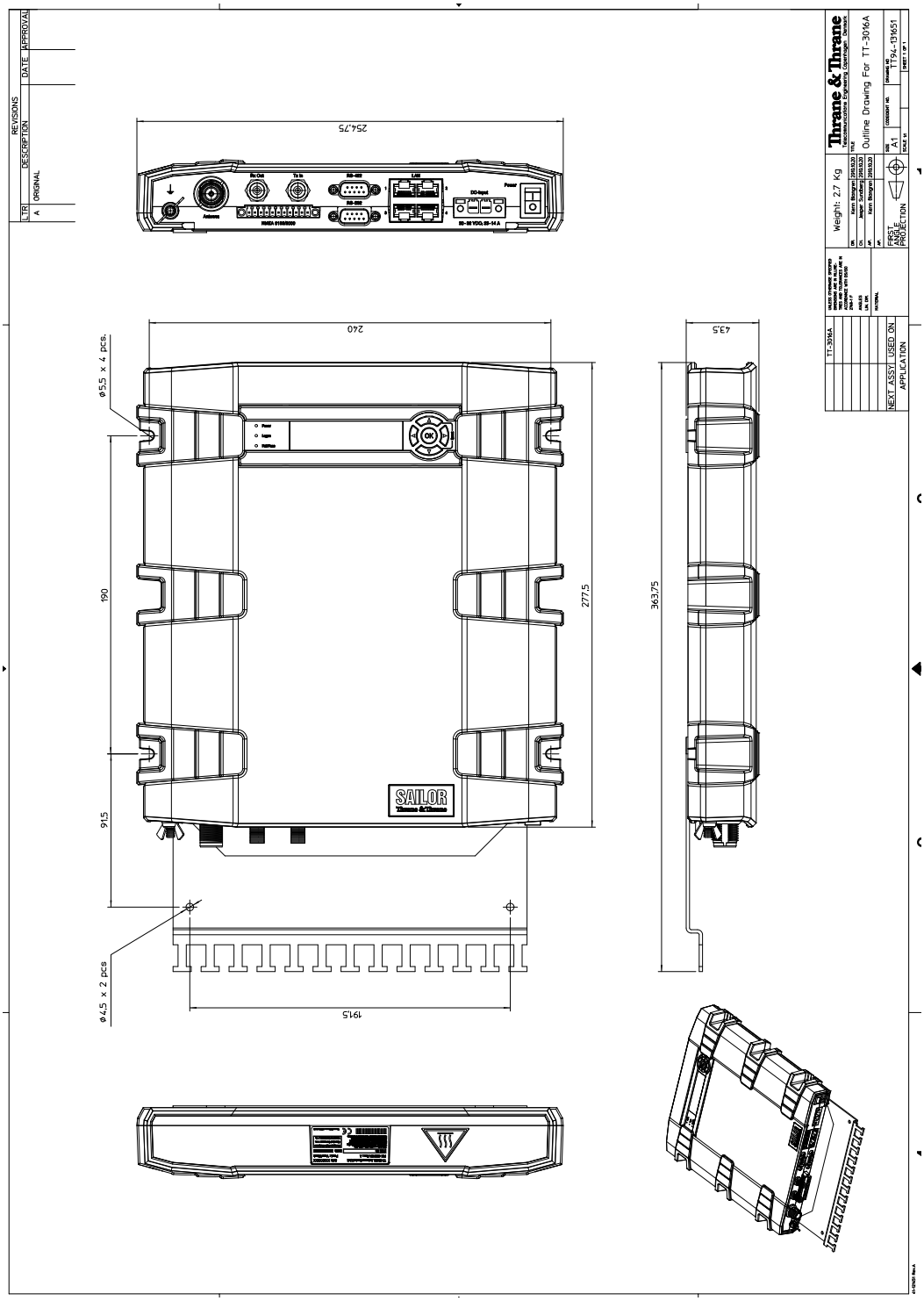

Figure A-2: Outline drawing: ACU, bulkhead

A.2.3 ACU, 19 inch rack

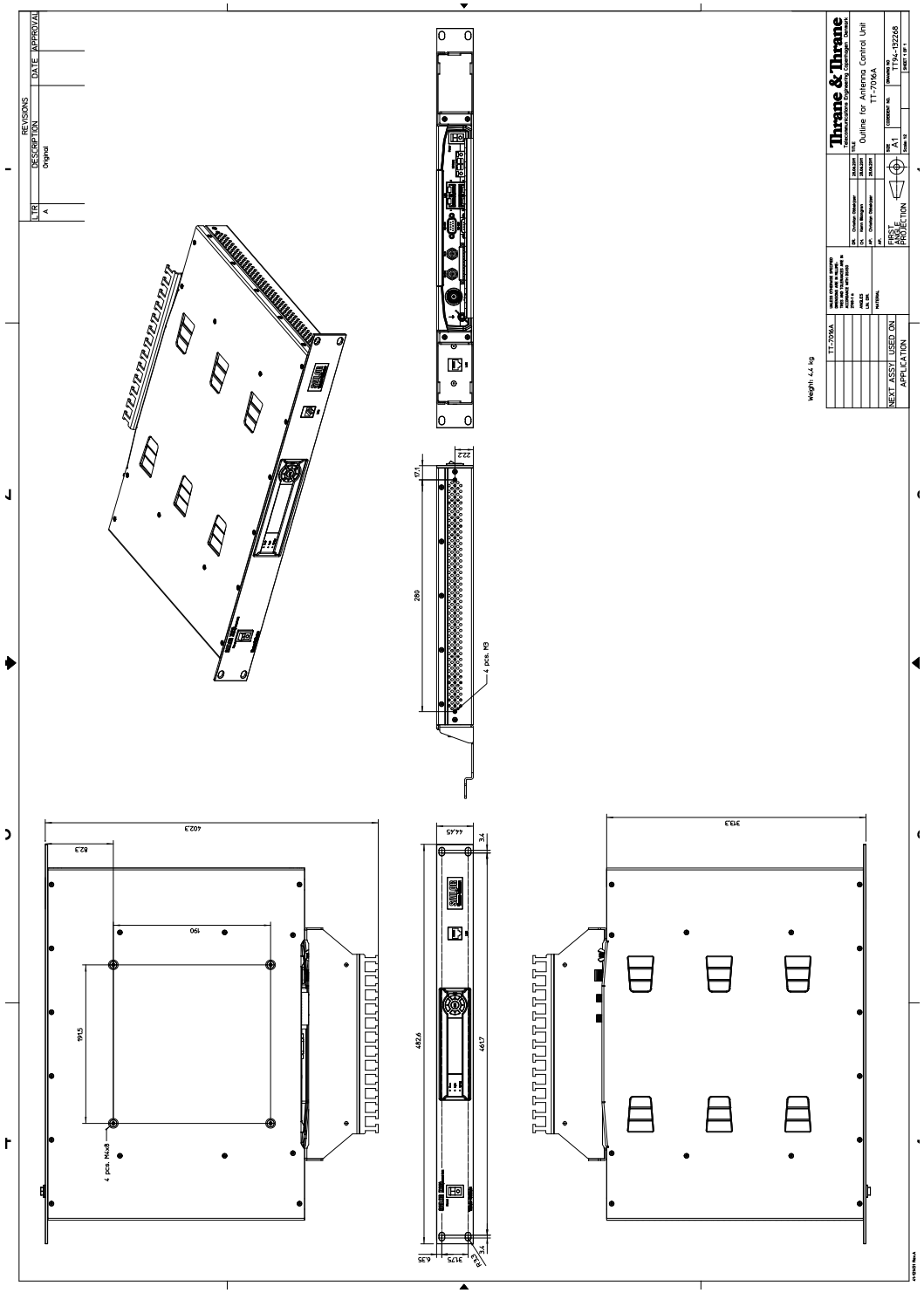

Figure A-3: Outline drawing: ACU, 19 inch rack

VMU cable specifications

This appendix contains cable specifications for cables between the ACU and a VSAT modem.

- *Modem Cable Comtech Serial & RSSI TT7016A*
- *Modem Cable iNIFINITI iDirect VSAT modem*

B.1 Modem Cable Comtech Serial & RSSI TT7016A

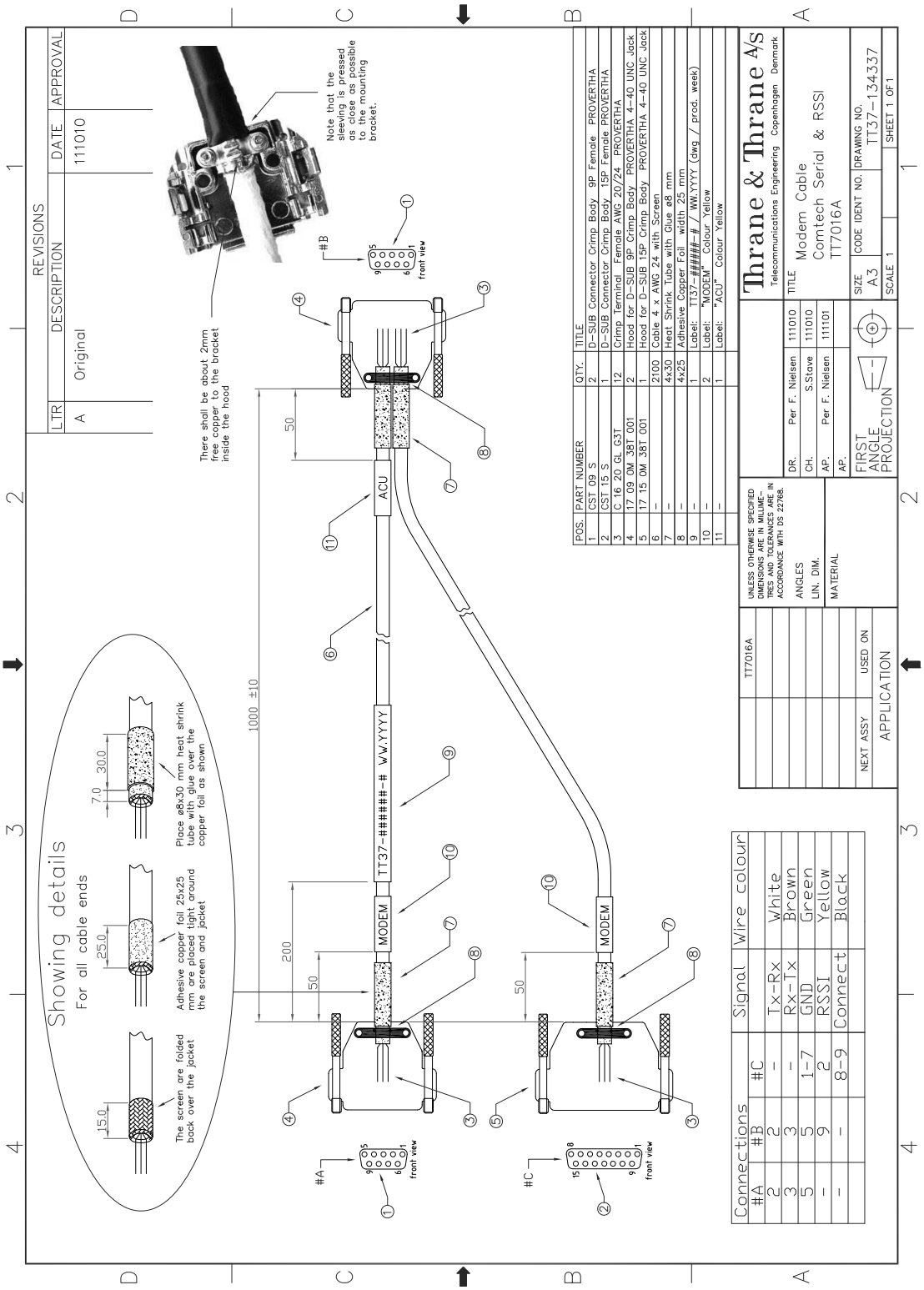

Figure B-1: Modem Cable Comtech Serial & RSSI TT7016A

B.2 Modem Cable iNIFINITI iDirect VSAT modem

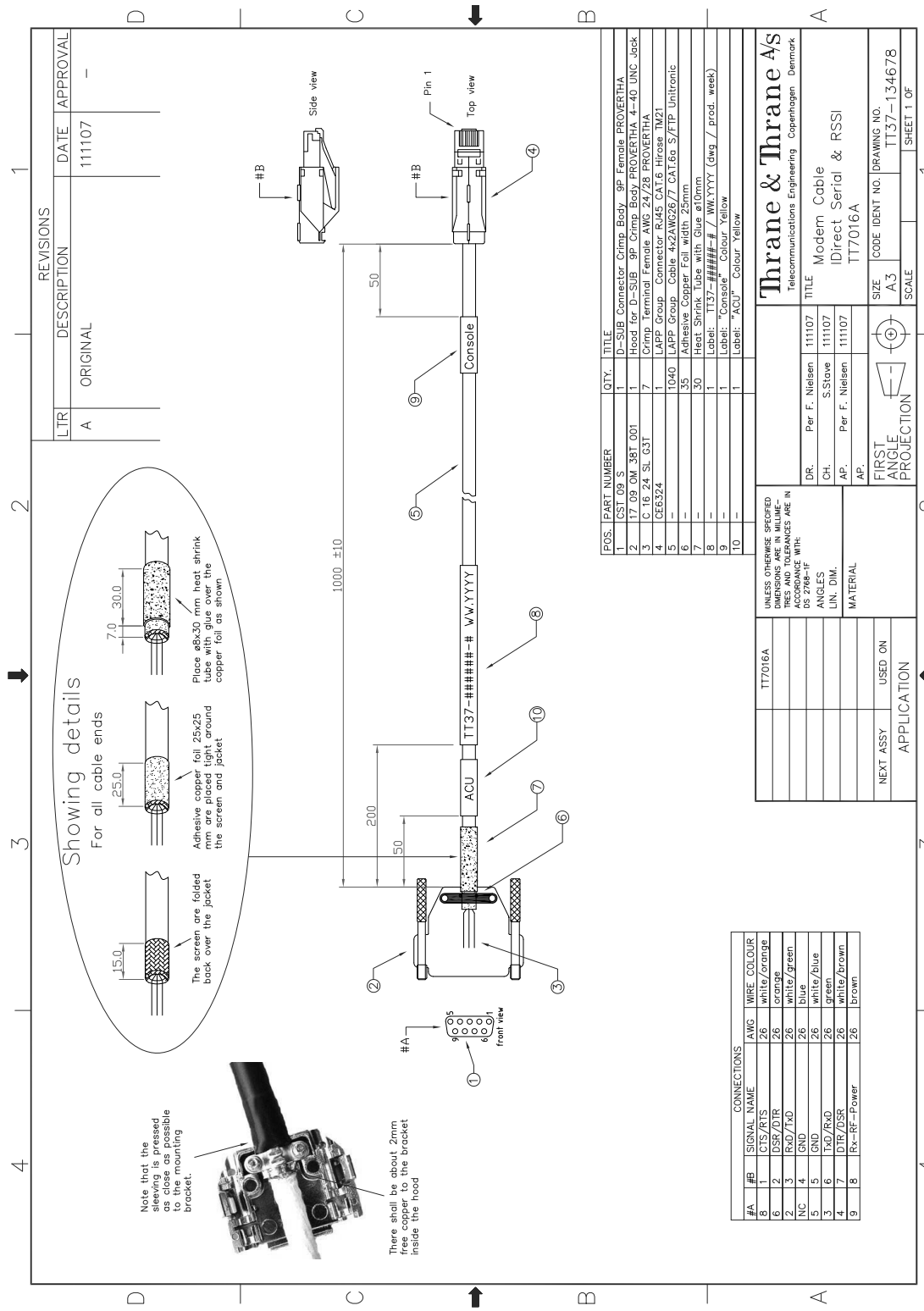

Figure B-2: Modem Cable iNIFINITI iDirect VSAT modem

VMU settings requirements

In this appendix you find detailed information how to set up supported VSAT modems. The following VSAT modems are described:

- *Open AMIP setup for iDirect INFINITI 5000 & Evolution X5*
- *Non-Open-AMIP setup for iDirect iNFINITI 5000 & Evolution X5*
- *Setup of Comtech 570L, ROSS box & ACU*

C.1 Open AMIP setup for iDirect INFINITI 5000 & Evolution X5

C.1.1 Protocol and interfaces

Introduction

The following sections describe the protocol and interface between the SAILOR 900 VSAT ACU and an iDirect OpenAMIP VSAT modem. OpenAMIP operation is normally used by service providers offering global VSAT service as the protocol supports roaming between satellites.

OpenAMIP, an ASCII message based protocol invented and Trademarked by iDirect is a specification for the interchange of information between an antenna controller (ACU) and a VSAT modem (VMU). This protocol allows the VSAT modem to command the ACU to seek a particular satellite as well as allowing exchange of information necessary to permit the VSAT modem to initiate and maintain communication via the antenna and the satellite. In general, OpenAMIP is not intended for any purpose except to permit a modem and the ACU to perform synchronized automatic beam switching.

Thrane & Thrane A/S received OpenAMIP certification for SAILOR 900 VSAT from VT iDirect Inc on 22 September 2011.

Connections

Connect the ACU and iDirect modem with the following cables:

- Ethernet cable for TCP/IP data communication
- RS-232 console cable for signal strength indication
- 75 RF cables F-F connectors for rx and tx frequencies.

See *Connecting an iNFINITI® 5000 Series Satellite Router* on page 4-9 and *Connecting an Evolution® X5 Satellite Router* on page 4-10 for details on cable connections and pin allocation for the RS-232 Console cable.

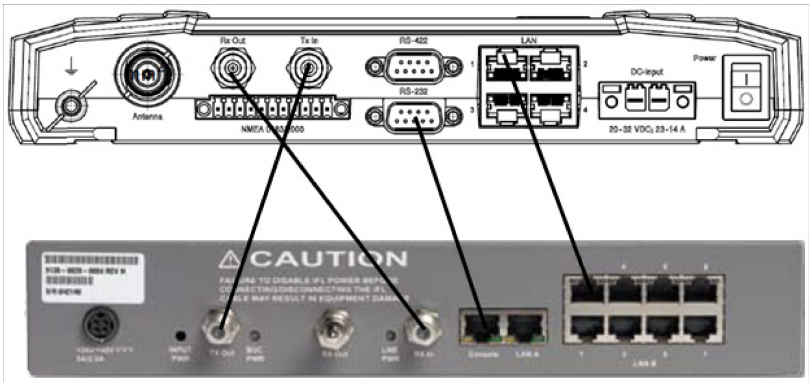

Figure C-1: Connecting iDirect iNFINITI 5000 series to the ACU (OpenAMIP)

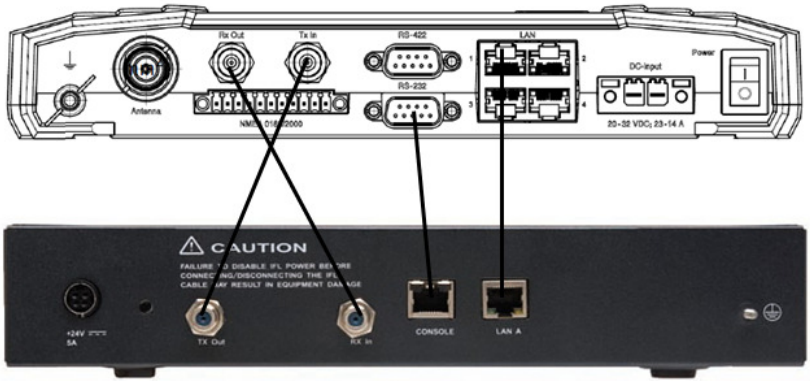

Figure C-2: Connecting iDirect Evolution X5 to the ACU (OpenAMIP)

Protocol

The SAILOR 900 VSAT ACU supports all OpenAMIP commands except the X command which is optional. All the supported OpenAMIP commands are shown in the following figure.

	Messages Sent from Remote				Messages Sent from Antenna	
iDS/iDX Release	Message	# Para-meters	Mapped to Options File Keys	Options File Group	Message	# Para-meters
iDX 2.0.x	A		keepalive_interval Default value of 15 seconds. Will not appear in Options file unless overwritten.	[ANTENNA]	a	
	B	2	rx_lcl_osc, tx_lcl_osc	[SATELLITE]		
	H	2	hunt_frequency, hunt_bandwidth	[SATELLITE]		
	K	1	max_skew Maximum skew of the beam short axis to the geosynchronous arc.	[SATELLITE]		
	P	2	polarity, tx_polarity	[SATELLITE]		
	S	3	longitude, max_lat, pol_skew	[SATELLITE]	s	2
	T	2	tx_frequency, tx_bandwidth	[SATELLITE]		
	W	1	latlong_interval Message contains single value in seconds. Does not generate Options file key.	[MOBILE]	w	4

Figure C-3: Supported OpenAMIP commands

Messages sent from VSAT modem	Explanation
S -15.000000 0.000000 0.000000	Longitude, Max_lat, Pol_skew
H 1451.815000 1.905000	Hunt_frequency, Hunt_bandwidth
P H V	Rx_polarity, Tx_polarity
B 11250.000000 12800.00000	Rx-lcl_osc, Tx_lcl_osc
T 1403.290000 0.618000	Tx_frequency, Tx_bandwidth
A 15	Keepalive_interval in mS [ACU: s message]
W 300	latlong_interval in seconds [ACU: w message]
L 1 1	Modem locked
K 90.000000	Max_skew

Table C-1: Messages sent from the VSAT modem to the ACU (examples)

Messages sent from the ACU to the VSAT modem	Explanation
s 1 1	Functional, Tx OK
w 1 55.794010 12.52272 985523005	GPS valid, Latitude, Longitude, Time

Table C-2: Messages sent from the ACU to the VSAT modem (examples)

Note The iDirect modems only sends the satellite information once when booting. If the ACU has not received the information for some reason, the system cannot point. In that case the modem will automatically boot after 5 minutes and send the satellite information again.

The signal strength from the modem is measured on RS-232 pin 9. It is a DC voltage in the range of 0 - 5 VDC.

Ranges for signal strength	
VDC	**Antenna status**
0-2.5	RF energy is detected, but from the wrong satellite.
2.6-5.0	Carrier lock, correct satellite.

Table C-3: Ranges for signal strength for iDirect Open AMIP VSAT modem

The signal strength displayed web interface on the Dashboard as 0 – 500. The minimum value for an Internet connection is 250 - 260.

C.1.2 Sample options file

The following section presents a portion of a sample iDX 2.0.x Options file with OpenAMIP messages and parameters defined. OpenAMIP keys appear highlighted in bold.

```
[OPTIONS_FILE]
product_mode = idirect_scpc
modem_sn = 40170
generated_by = NMS-10.0.0
did = 12885226
modem_type = Remote
modem_hardware = 5000
```

```
is_mesh = 0
disable_options_flash_command = 0
carrier_type = 0
...
[MOBILE]
is_mobile = 1
tx_handshake_enabled = 0
gps_input = 2
latlong_interval = 300
latlong_fail_interval = 10
init_tx_power_offset = 0.000000
[MAPSERVER_0]
hostname = 172.20.130.3
port = 5003
[BEAMS]
beam_21 = PPS_Perf_Eval
maxbeam = 21
[ANTENNA]
manufacturer = OpenAMIP
model = OpenAMIP
addr = 172.26.81.34
port = 2000
connect_timeout = 30
dedicated_interface = ixp1
[SATELLITE]
min_look_angle = 0.000000
tx_frequency = 1200.000000
tx_bandwidth = 36.000000
hunt_bandwidth = 36.000000
rx_lcl_osc = 11250.000000
tx_lcl_osc = 12800.000000
max_skew = 90.000000
```

```
name = T12
channelname = T12_EMEA
longitude = -15.000000
max_lat = 0.000000
pol_skew = 0.000000
hunt_frequency = 1075.000000
polarity = H
tx_polarity = X
noise_reference_frequency = 0.000000
```

The option file must use following information:

Section in the option file	Requirements
[SATELLITE]	The modem must use the following up and down conversion frequencies for rx and tx! SAILOR 900 VSAT has O-Type LNBs (Co-Pol & X-Pol) with following Local Oscillator (LO) down conversion frequencies: – 9.75 GHz – 10.25 GHz – 10.75 GHz – 11.25 GHz Example: “rx_lcl_osc = 11250.000000” SAILOR 900 has an extended 8 Watt BUC with LO up conversion frequency of 12.8 GHz. – Example: “tx_lcl_osc = 12800.000000”

Table C-4: Information in the VSAT modem option file

Section in the option file	Requirements
[MOBILE]	The iDirect modem must be set to mobile unit and receive the GPS information from the ACU with the command “w <Valid> <Lat> <Lon> <Time>”. **Example:** “is_mobile = 1” Tx handshake must not be enabled in the iDirect modem. **Example:** “tx_handshake_enabled = 0”
[ODU]	The SAILOR 900 VSAT can work either using the Rx 10 MHz reference signal provided by the modem or using its own built-in 10 MHz reference signal. It is recommended to use the 10 MHz reference signal from the modem. **Example:** “odu_rx_10_mhz = 1” The SAILOR 900 VSAT needs the Tx 10 MHz reference signal in order to allow TX ON. **Example:** “odu_tx_10_mhz = 1”

Table C-4: Information in the VSAT modem option file (Continued)

C.1.3 Configuration examples (OpenAMIP)

Examples of modem profile and satellite configuration from the ACU web MMI are shown in the figures below.

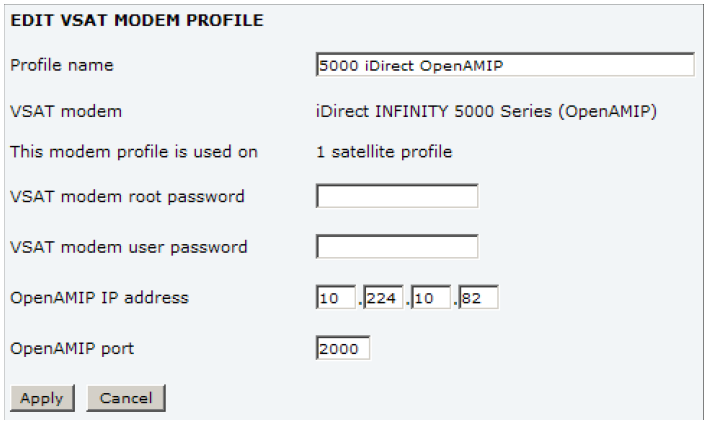

Figure C-4: VSAT modem profile, OpenAMIP (example)

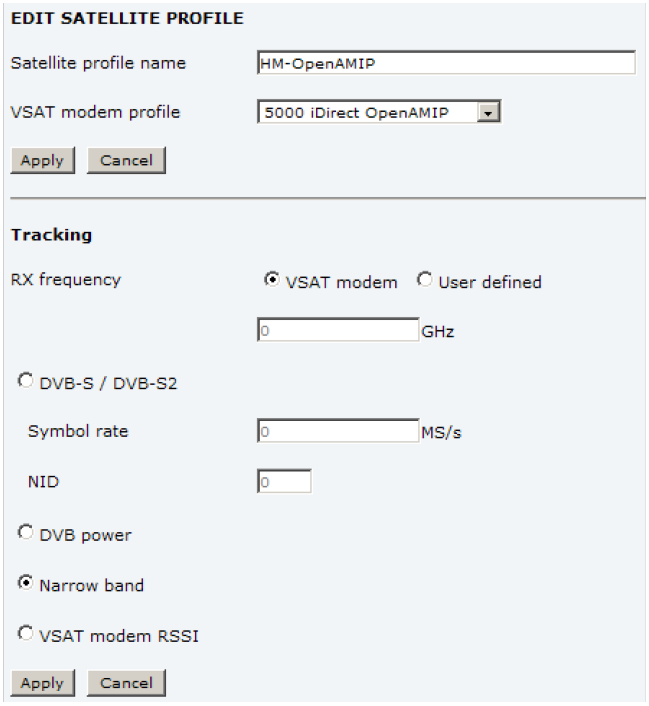

Figure C-5: Satellite profile, OpenAMIP (example)

C.2 Non-Open-AMIP setup for iDirect iNFINITI 5000 & Evolution X5

C.2.1 Protocol and interfaces

Introduction

The following sections describe the protocol and interface between the ACU and an iDirect Non-OpenAMIP modem. Non-OpenAMIP operation is normally used by service providers offering regional VSAT service.

Connections

Connect the ACU and iDirect modem with the following cables:

- RS-232 console cable for control communication
- 75 RF cables F-F connectors for rx and tx frequencies.

See *Connecting an iNFINITI® 5000 Series Satellite Router* on page 4-9 and *Connecting an Evolution® X5 Satellite Router* on page 4-10 for details on cable connections.

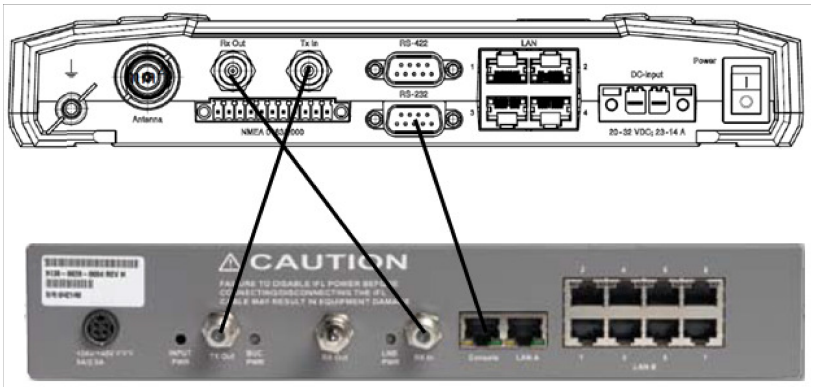

Figure C-6: Connecting iDirect iNFINITI 5000 series to the ACU (Non-OpenAMIP)

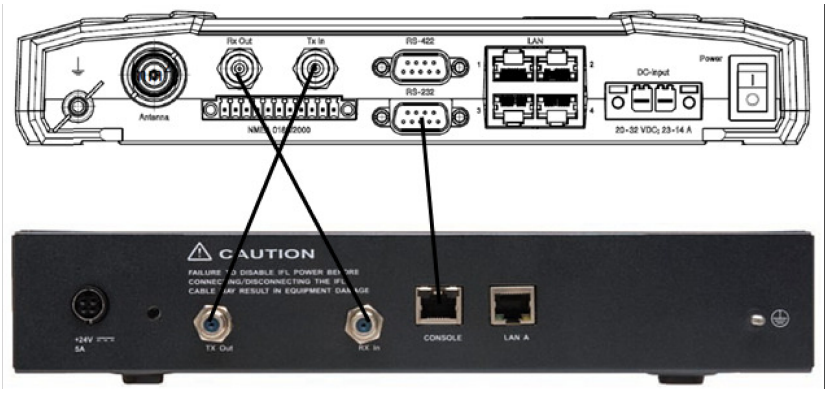

Figure C-7: Connecting iDirect Evolution X5 to the ACU (Non-OpenAMIP)

The pin allocation for the RS-232 Console cable is shown below.

Console Port(DTE)	RJ-45 Pin	Color Code	RJ-45 to DB-9 Adapter Pin	Console Device
RTS	1	Blue	8	CTS
DTR	2	Orange	6	DSR
TxD	3	Black	2	RxD
GND	4	Red	NC	GND
GND	5	Green	5	GND
RxD	6	Yellow	3	TxD
DSR	7	Brown	4	DTR
Rx-RF-Power	8	White/Grey	9	--

Figure C-8: RS-232 Console cable for iDirect Non-OpenAMIP VSAT modem

C.2.2 Console port settings

The iDirect modem must be configured to use following console port settings:

- Baud rate: 9600
- Data bits: 8
- Parity: None
- Stop bit: 1

Passwords

The SAILOR 900 VSAT ACU will log in to the modem using root and user passwords. The default passwords are:

- Root: P@55w0rd!
- User: iDirect

Supported commands

After login to the modem the ACU will issue commands to the modem every second. The following commands are supported by the SAILOR 900 ACU:

- rx snr
- options show FREQ_TRANS
- rx freq
- tx freq
- latlong <lat> <long>

The signal strength command: rx snr is issued every 2 seconds. The rest of the commands are issued one by one every 2 seconds between each signal strength command. Meaning each of the other commands is issued every 8 seconds.

The signal strength in the ACU display and web interface is shown as dB., e.g: 8.5 dB. The minimum value for Internet connection is around 2-3 dB.

VSAT modem option file

The option file of the VSAT modem must also include the following information:

Section in option file	Description
Satellite information	Receive frequency of the transponder. Used with “rx freq” command Transmit frequency if known otherwise just a dummy tx frequency (e.g. 1.000 MHz). Used with “tx freq” command.
SAILOR 900 VSAT information	The modem needs to use following up and down conversion frequencies for rx and tx. Used with “options show FREQ_TRANS” command. The SAILOR 900 VSAT has O-Type LNBs (Co-Pol & X-Pol) with following Local Oscillator (LO) down conversion frequencies: – 9.75 GHz – 10.25 GHz – 10.75 GHz – 11.25 GHz The SAILOR 900 VSAT has an extended 8 Watt BUC with LO up conversion frequency of 12.8 GHz.
GPS	The iDirect modem must be set to mobile unit and receive the GPS information from the ACU with the command “latlong <lat> <long>”. Tx handshake must be disabled in the iDirect modem.
Rx 10 MHz	The SAILOR 900 VSAT can work either using the Rx 10 MHz reference signal provided by the VSAT modem or using its own built-in 10 MHz reference signal. It is recommended to use the 10 MHz reference signal from the modem’s rx connector.
Tx 10 MHz	The SAILOR 900 VSAT needs the Tx 10 MHz reference signal in order to allow TX ON.

Figure C-9: Requirements for VSAT modem option file, Non-OpenAMIP

C.2.3 Configuration examples (Non-OpenAMIP)

Examples of modem profile and satellite configuration from the ACU web MMI are shown in the figures below.

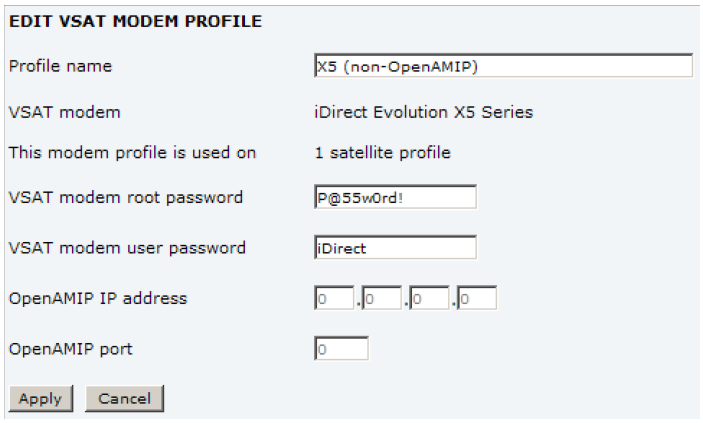

Figure C-10: VSAT modem profile, Non-OpenAMIP (example)

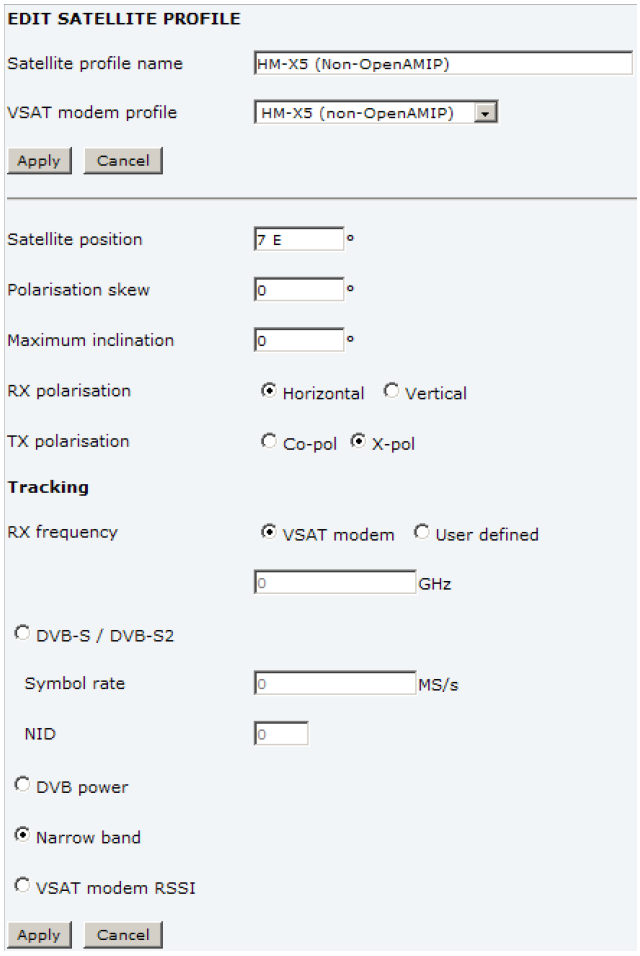

Figure C-11: Satellite profile, Non-OpenAMIP (example)

C.3 Setup of Comtech 570L, ROSS box & ACU

C.3.1 Protocols and interfaces

The following sections describe how to connect an ACU, a Comtech570L VSAT modem, a ROSS box and an Ethernet switch.

Connections

Connect the ACU and Comtech 570L, ROSS box and Ethernet switch with the following cables:

- Ethernet cables for TCP/IP data communication (x3)
- RS-232 console cable
- 75 RF cables F-F connectors for rx and tx frequencies.

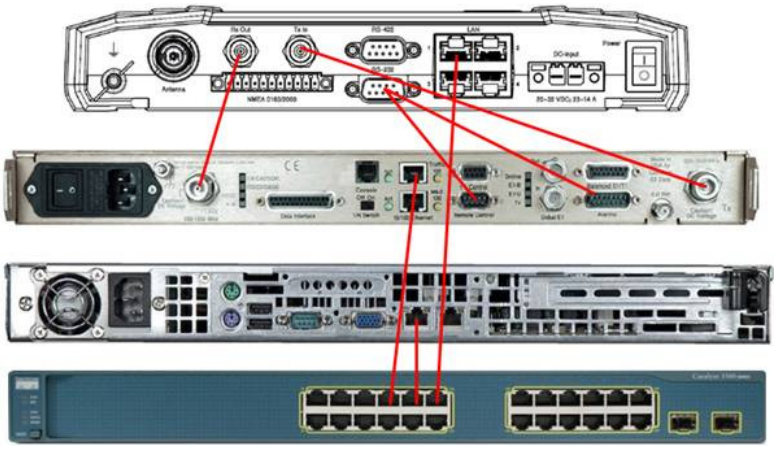

Figure C-12: Connecting Comtech 570L and ROSS box to the ACU (example)

See also *Connecting a Comtech 570 L or 625 Satellite Modem* on page 4-11 and cable specifications at *Modem Cable Comtech Serial & RSSI TT7016A* on page B-2.

Grounding and RF protection

D.1 Why is grounding required?

D.1.1 Reasons for grounding

Grounding the SAILOR 900 VSAT system is required for at least two reasons:

- Safety: Lightning protection of persons and equipment.
- Protection: ESD (ElectroStatic Discharge) protection of equipment.

D.1.2 Safety

First of all grounding of the system is required for safety reasons. In the event of a lightning strike at the ADU a proper grounding of the system will provide a low resistance path to divert the strike discharge to seawater.

D.1.3 ESD Protection

The ESD protection circuits in the ACU rely on proper grounding of the system in order to work properly. Otherwise sensitive circuits within the ACU might be damaged due to ESD when you are handling the equipment.

D.2 Grounding Recommendations

D.2.1 Grounding the ACU

The ACU should be grounded to the ship/hull. For this purpose you may use a short ADU cable and a grounding kit. Further, the ACU must be grounded at its grounding stud in order to ensure proper grounding if the short ADU cable is disconnected. For further information, see *Grounding the terminal* on page 2-33.

If you are using the Extended cable support, make the ground connections through the cable support. You may need to extend the ground plane using copper foil, see the following section.

Extending the ground plane

In some cases it may not be possible to access the hull and at the same time place the ACU in a suitable place.

A way to insure good grounding and at the same time make it possible to ground the coax cable - is to extend the ship ground plane by means of copper foil. The maximum length of the foil is determined by the width of the foil:

Copper foil 5 cm wide: Max 50 cm
Copper foil 10 cm wide: Max 100 cm
Copper foil 20 cm wide: Max 200 cm

Note The foil must be at least 0.1 mm thick.

Connect the foil to the hull by plenty of screws or hard-soldering. Run the foil past the place where the short ADU cable is to be grounded and mount a grounding kit on top of the foil.

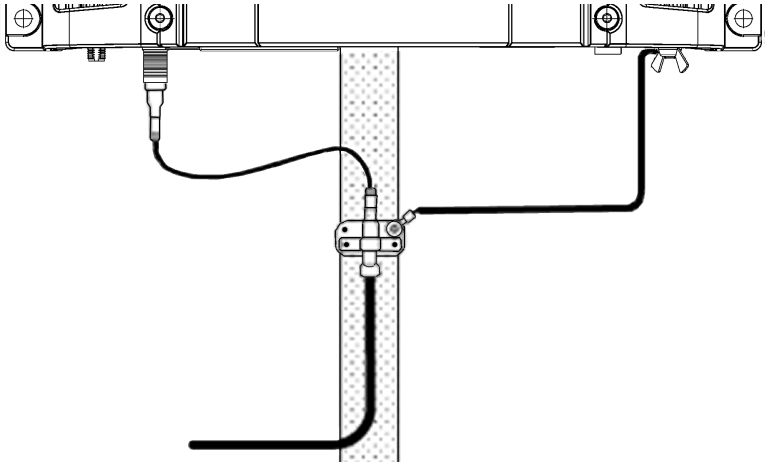

Figure D-1: Extending the ground plane

D.2.2 Grounding the ADU

You can ground the ADU to the ship/hull via one or more of its mounting bolts. Make sure to remove painting, dirt, grease etc. at the mounting holes in order to make good electrical contact to the hull. Use serrated washers when securing the mounting bolts and seal the joint with protective coating to avoid corrosion.

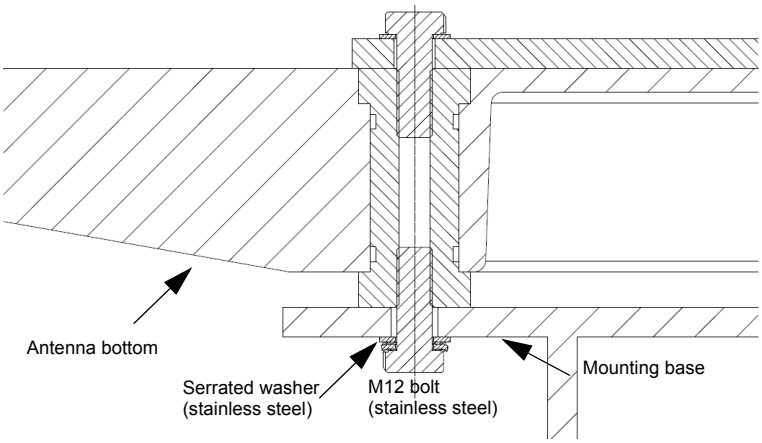

Figure D-2: Grounding the ADU

It is always recommended to establish the shortest possible grounding path e.g. on steel hulls the ADU should be grounded directly to the hull [1]. However, due to the fact that this is not possible on e.g. fiberglass hulls (nor is it preferable on aluminum hulls) a number of alternative grounding methods are suggested in the following paragraphs.

1. Please note that the ADU ground connection is made at the same electrical ground potential as the ACU.

D.3 Alternative grounding for steel hulls

The following guidelines assume a two-wire, isolated grounding arrangement; that is no part of the circuit, in particular the battery negative, is connected to any ground potential or equipment.

D.3.1 Grounding the ACU

The ACU must be grounded to the ship with the short cable. Further, the ACU must be grounded at its grounding stud in order to ensure a proper grounding if the short ADU cable is disconnected.

The ground connection can be established either at the hull (recommended) or at a dedicated RF ground if available (alternative). However, bear in mind that the ADU ground connection is to be made at the **same electrical ground potential as the ACU** (see *Grounding the ADU*).

The ACU provides galvanic isolation (as required) from its input power terminals to the chassis/grounding stud. This way the isolated grounding arrangement is maintained.

D.3.2 Grounding the ADU

Terminal grounded at the hull (recommended)

In this case the ADU is grounded to the ship via one (or more) of its mounting bolts. Make sure to remove painting, dirt, grease etc. at the mounting holes in order to make good electrical contact to the hull. Use serrated washers when securing the mounting bolts and seal the joint with protective coating to avoid corrosion.

Terminal grounded at a dedicated RF ground (alternative)

In this case the ADU is grounded with a separate ground cable. The ground cable must be routed parallel and close to the shielded coax cable connecting the ADU to the ACU grounding kit. A tinned heavy gauge wire (min. 6 mm2) can be used for this purpose.

Note The ADU must be electrically isolated at its mounting bolts by means of shoulder bushings and washers ensuring the isolated RF ground - see *Isolation of the ADU from the mounting base* on page D-10.

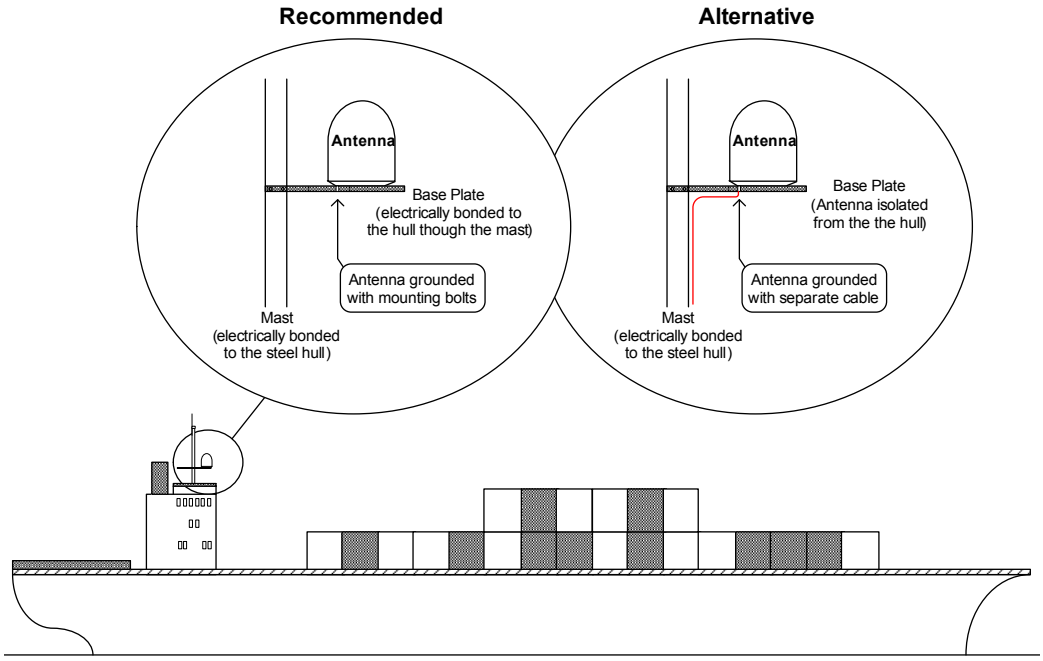

Figure D-3: Grounding at a dedicated RF ground (alternative)

D.4 Alternative grounding for aluminum hulls

The following guidelines assume a two-wire, isolated grounding arrangement; that is no part of the circuit, in particular the battery negative, is connected to any ground potential or equipment.

D.4.1 Grounding the ACU

The ACU must be grounded with the short cable. Further, the ACU must be grounded at its grounding stud to ensure a proper grounding if the short ADU cable is disconnected.

The ground connection must be established at a dedicated RF ground (either capacitively or electrically coupled). Remember to make the ADU ground connection at the **same electrical ground potential** as the ACU (see *Grounding the ADU*).

The ACU provides galvanic isolation (as required) from its input power terminals to the chassis/grounding stud. This way the isolated grounding arrangement is maintained.

D.4.2 Grounding the ADU

If the mounting base of the ADU is electrically connected to the hull (or any other ground potential than the ACU), the ADU must be isolated at its mounting bolts by means of shoulder bushings and washers, see D.6.3. This is done in order to prevent DC currents flowing in the hull thus causing electrolytic corrosion.

However, a ground connection must be established via one of the mounting bolts using a separate ground cable. The ground cable must be routed parallel and in close

proximity to the shielded coax cable hence connecting the ADU to the ACU Grounding kit. A tinned heavy gauge wire (min. 6 mm^2) can be used for this purpose.

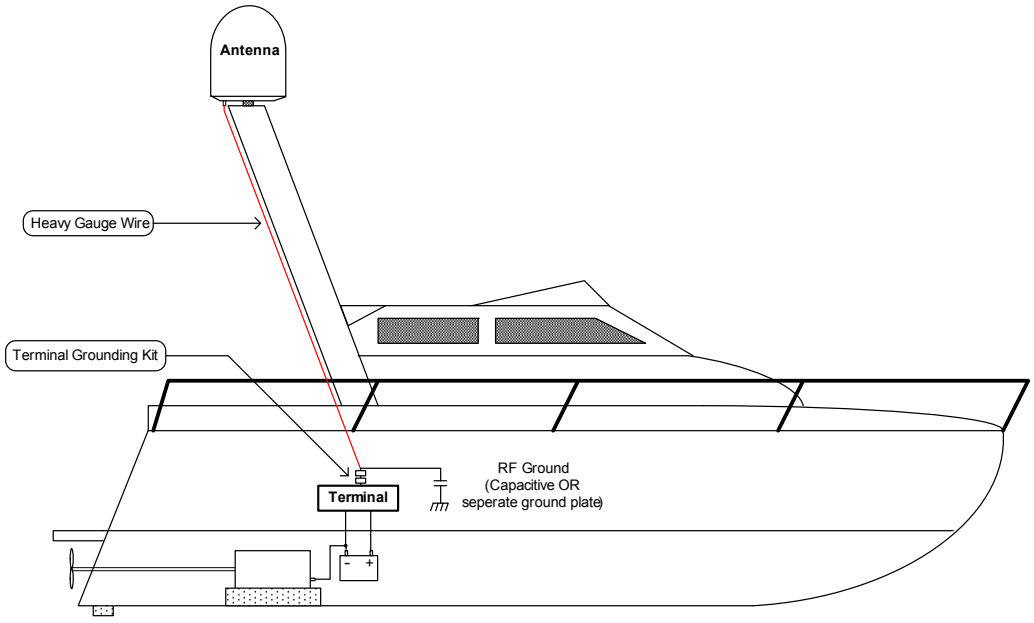

Figure D-4: Alternative grounding for aluminium hulls

D.5 Alternative grounding for fiberglass hulls

D.5.1 Grounding the ACU

The ACU must be grounded with the short ADU cable and a grounding kit (available from Thrane & Thrane). Further, the ACU must be grounded at its grounding stud in order to ensure a proper grounding if the short ADU cable is disconnected.

The ground connection must be established at a dedicated RF ground (either capacitive or electrical coupled). Bear in mind that the ADU ground connection is to be made at the **same electrical ground potential** as the ACU (see *Grounding the ADU*).

D.5.2 Grounding the ADU

If the mounting base of the ADU is electrically connected to any other ground potential than the ACU (e.g. Lightning Ground), the ADU must be isolated at its mounting bolts by means of shoulder bushings and washers - see page D-10.

However, a ground connection must be established via one of the mounting bolts using a separate ground cable. The ground cable must be routed parallel and in close

proximity to the shielded coax cable hence connecting the ADU to the ACU Grounding kit. A tinned heavy gauge wire (min. 6 mm2) can be used for this purpose.

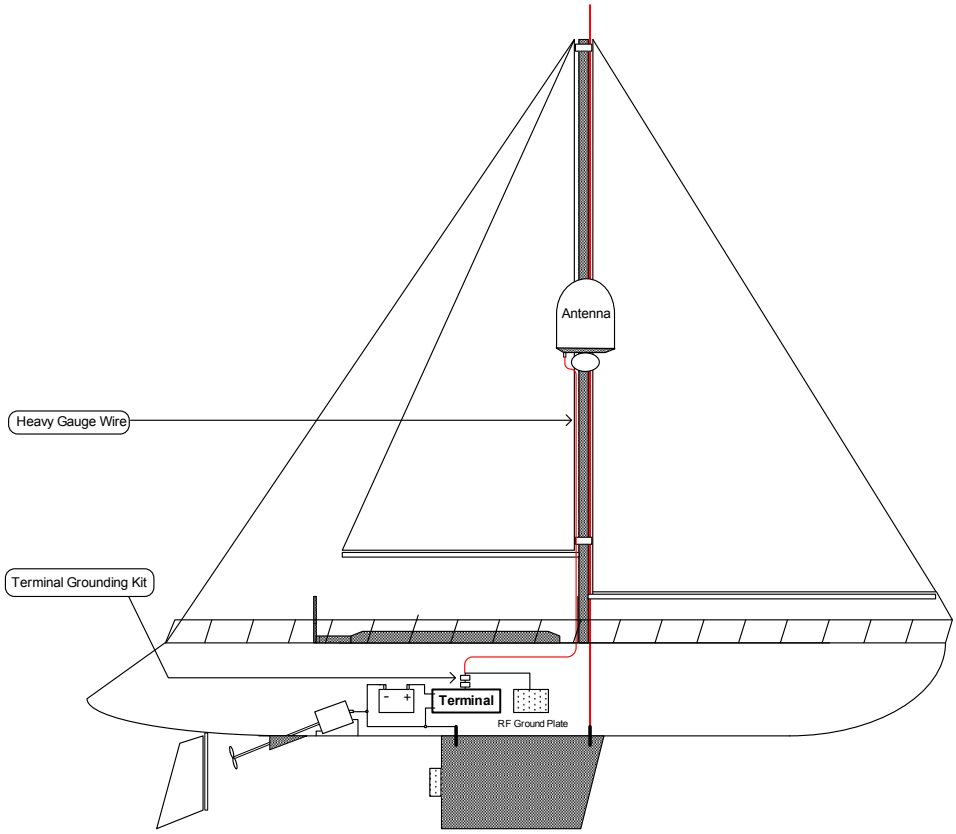

Figure D-5: Alternative grounding for fiberglass hulls

D.6 Separate ground cable

D.6.1 Ground cable - construction

When dealing with electrical installations in a marine environment, all wiring must be done with double insulated, tinned, high quality and if exposed also UV resistant cables. This shall also apply to the separate ground cable mentioned in the previous paragraphs.

The ground cable is constructed using an appropriate cable with a cross section area of at least 6 mm^2 (AWG10) and terminated with insulated ring crimp terminals – see illustration below. The crimp terminals must be a marine approved type e.g. the DuraSeal series from Raychem.

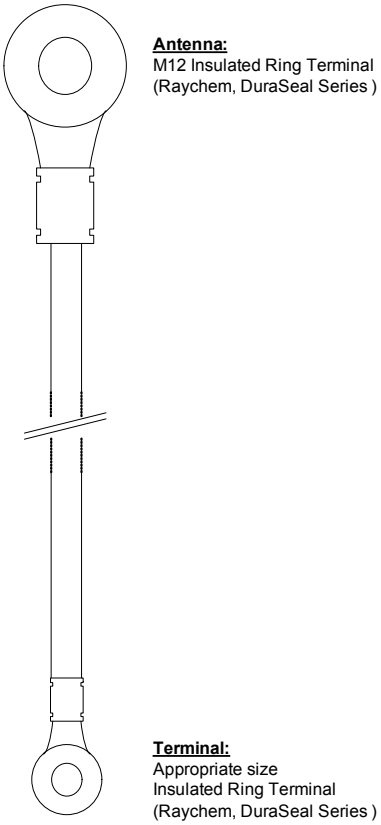

Figure D-6: Separate ground cable

D.6.2 Ground cable - connection

Mount the ground cable close to and parallel to the shielded coax cable thus minimizing ground loop problems. If possible, route the coax cable and the ground cable in metal conduits bonded to the hull or within a mast (depending on the actual installation).

The ground cable must be connected at one of the mounting/grounding bolts on the ADU. Use bolts and washers of stainless steel and seal the joint with protective coating to avoid corrosion. If the ADU is to be isolated from the mounting base, shoulder bushings and washers must be used – see figure D-7, *Isolation of the ADU from the mounting base* on page D-10.

At the other end, connect the ground cable as described in *Grounding the ACU* on page D-2.

D.6.3 Isolation of the ADU from the mounting base

In cases where the ADU is to be isolated from the mounting base, shoulder bushings and washers (accessories) must be used as illustrated below. Please note that the isolation has to be implemented on all four mounting bolts (including the bolt securing the ground cable).

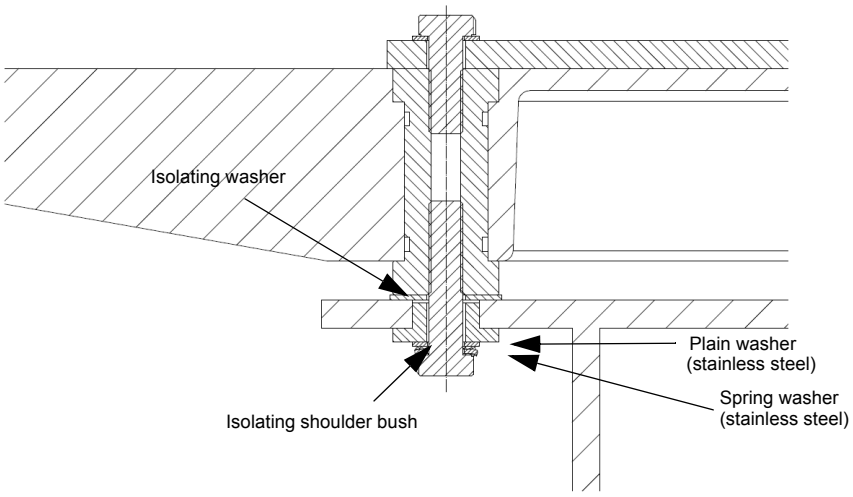

Figure D-7: Isolation of the ADU from the mounting base

The ground cable must be connected at one of the mounting/grounding bolts on the ADU as illustrated below. Remember to seal the joint with protective coating to avoid corrosion.

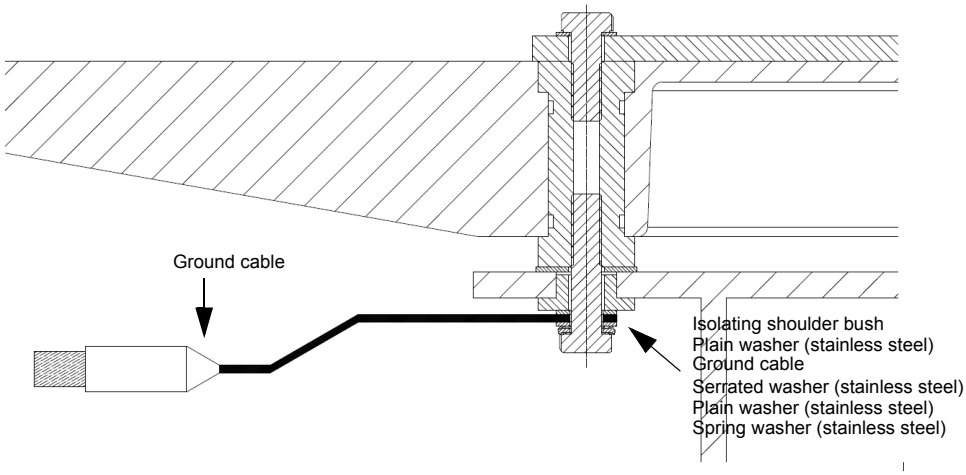

Figure D-8: ADU isolation and grounding cable

D.7 RF interference

Interference induced from nearby high-power RF transmitters might cause system failures and in extreme cases permanent damage to the SAILOR 900 VSAT equipment. If there are problems with interference from HF transmitters, it is advisable to mount ferrite clamps on the coax cable in order to provide suppression of induced RF. The ferrites will have no effect on the differential-mode signals but increases the impedance in relation to common-mode RFI.

D.7.1 Recommendations

Use 1-5 pcs. hinged clamp cores (e.g. the RFC or SFC series from Kitagawa) mounted on the ADU cable near the ADU.

System messages

E.1 Event messages – overview

The SAILOR 900 VSAT detects events during

- POST (Power On Self Test) – a self test performed at every power-up.
- Self test – started in the web interface
- CM (Continuous Monitoring) – continuous monitoring while the system is in operation.

When the SAILOR 900 VSAT detects an event that requires your action, it issues an event message and the red Fail/Pass LED in the LED panel of the ACU is lit. As long as an event is active, it is shown in the ACU display and the web interface (in HELPDESK > Event list or click the event icon on the DASHBOARD).

Note Active events and notifications are shown. As soon as the event is cleared, it is not displayed any longer. Notifications are cleared after 24 hours.

State the Event ID when contacting your service partner.

The event description might contain a number of digits in brackets, e.g. (0000000005). This is supplemental information and used for service and diagnostics purposes.

E.2 List of ADU events

Error code (ID)	Unit	Severity	Description	Explanation
0a001-0	Antenna	ERROR	Production data	Production data is invalid
0a002-0	Antenna	ERROR	XIM internal	Antenna configuration data stored in the PCM module is invalid
0a003-0	Antenna	ERROR	XIM external	Antenna configuration data stored in the VIM module is invalid
0a004-0	Antenna	ERROR	XIM I/X match	Antenna configuration data stored in the PCM module does not match the configuration data stored in the VIM module
0a005-0	Antenna	ERROR	Antenna type	The configuration antenna type is unsupported or unknown
0a006-0	Antenna	ERROR	PCM FPGA load	The PCM FPGA cannot be initialised and loaded correctly
0a007-0	Antenna	ERROR	VIM FPGA load	The VIM FPGA cannot be initialised and loaded correctly
0a010-0	Antenna	ERROR	GPS initialisation	The GNSS device cannot be initialised. Check cable and GNSS device
0a020-0	Antenna	ERROR	AMB device discovery	Missing one or more of the following devices: ISM, DDM and PMM. Check cables.
0a021-0	Antenna	ERROR	Azi DDM ABS device	Cannot initialise the azimuth DDM
0a022-0	Antenna	ERROR	Xel DDM ABS device	Cannot initialise the cross-elevation DDM
0a023-0	Antenna	ERROR	Ele DDM ABS device	Cannot initialise the elevation DDM
0a024-0	Antenna	ERROR	ISM ABS device	Cannot initialise the ISM

Table E-1: ADU event messages

Error code (ID)	Unit	Severity	Description	Explanation
0a025-0	Antenna	ERROR	PMM ABS device	Cannot initialise the azimuth PMM
0a030-0	Antenna	ERROR	Sensor sanity	Too many invalid values measured by the ISM during initialisation. Check for vibrations or malfunctioning ISM.
0a033-0	Antenna	ERROR	Azi axis calibration	Zero reference point (hall sensor) not found on azimuth axis. Check azimuth belt and hall sensor including magnet
0a034-0	Antenna	ERROR	Xel axis calibration	End stops of the cross-elevation axis not found at expected locations. Check belt and end stops.
0a035-0	Antenna	ERROR	Ele axis calibration	End stops of the elevation axis not found at expected locations. Check belt and end stops.
0a036-0	Antenna	ERROR	Pol axis calibration	Zero reference point (hall sensor) not found on polarisation axis. Check movement of the polarisation unit and the hall sensor including magnet
0a037-0	Antenna	ERROR	Antenna calibration	One or more errors occurred during antenna start-up
0a040-0	Antenna	ERROR	Demodulator load	The second receiver demodulator cannot be initialised and loaded correctly
0a041-0	Antenna	ERROR	VIM PLL lock	The PLL on the VIM does not lock.
0a042-0	Antenna	ERROR	ISM calibration data	The ISM calibration data is invalid. The ISM should be replaced.
0a052-0	Antenna	WARNING	ACU communication	The communication link between ACU and antenna is down
0a053-0	Antenna	WARNING	ISM data valid	Sensor measurements from the ISM are invalid. This indicates a malfunctioning ISM
0a054-0	Antenna	WARNING	ISM data range	Sensor measurements from the ISM are out of range

Table E-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0a055-0	Antenna	WARNING	GNSS communication	Lost connection to the GNSS device
0a056-0	Antenna	WARNING	GNSS data range	Received information from the GNSS device which is out of range
0a057-0	Antenna	WARNING	GNSS device warning	Local GNSS device warning
0a058-0	Antenna	WARNING	GNSS device error	Local GNSS device error
0a059-0	Antenna	ERROR	Azi DDM shutdown	The azimuth motor control has detected one of the following situations: Extreme temperature, voltage, current or velocity. The motor was then shut down. This is usually a temporary situation and is probably fixed by a restart of the system.
0a060-0	Antenna	ERROR	Xel DDM shutdown	As Azi DDM shutdown but detected by the cross-elevation motor control.
0a061-0	Antenna	ERROR	Ele DDM shutdown	As Azi DDM shutdown but detected by the elevation motor control.
0a062-0	Antenna	ERROR	PMM shutdown	As Azi DDM shutdown but detected by the polarisation motor control.
0a063-0	Antenna	WARNING	AMB timing	This indicates a busy situation. It may occur during installation procedures. No user interaction is required.
0a064-0	Antenna	WARNING	VIM cable attn	The output power cannot be controlled correctly. Check the Tx chain
0a065-0	Antenna	WARNING	BUC voltage low	The voltage for the BUC is too low probably caused by a malfunctioning VIM or BUC
0a066-0	Antenna	WARNING	BUC voltage high	The voltage for the BUC is too high probably caused by a malfunctioning VIM
0a067-0	Antenna	WARNING	LNB voltage low	The voltage for the LNB is too low probably caused by a malfunctioning VIM or LNB

Table E-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0a068-0	Antenna	WARNING	LNB voltage high	The voltage for the LNB is too high probably caused by a malfunctioning VIM
0a069-0	Antenna	WARNING	PMM fan	The fan is not working or the tacho input from the fan is not connected. Check cable and fan.
0a070-0	Antenna	WARNING	OMT temperature	The temperature of the BUC is too high. Check if fan is working.
0a071-0	Antenna	ERROR	VIM PLL lock	The PLL of the VIM is out of lock. Check the 10 MHz reference signal.
0a072-0	Antenna	WARNING	VIM tuner lock	The PLL of the second receiver (DVB) is out of lock. Check the 10 MHz reference signal
0a073-0	Antenna	WARNING	Azi encoder slip	A slip of the azimuth encoder has been detected. No user interaction is required unless this is a permanent situation in which case the belt and encoder of the azimuth axis must be checked
0a074-0	Antenna	WARNING	Xel encoder slip	A slip of the cross-elevation encoder has been detected. No user interaction is required unless this is a permanent situation in which case the belt and encoder of the cross-elevation axis must be checked
0a075-0	Antenna	WARNING	Ele encoder slip	A slip of the elevation encoder has been detected. No user interaction is required unless this is a permanent situation in which case the belt and encoder of the elevation axis must be checked
0a076-0	Antenna	WARNING	Pol encoder slip	A slip of the polarisation encoder has been detected. No user interaction is required unless this is a permanent situation in which case the encoder of the polarisation axis must be checked

Table E-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0a077-0	Antenna	WARNING	GNSS position	No position available from the GNSS device or position too old.
0a078-0	Antenna	WARNING	GNSS velocity	No velocity available from the GNSS device
0a079-0	Antenna	ERROR	Heading data	Heading information is missing in the antenna
0a080-0	Antenna	ERROR	Azi DDM communication	Communication error between PCM and azimuth DDM. Check cable.
0a081-0	Antenna	ERROR	Xel DDM communication	Communication error between PCM and cross-elevation DDM. Check cable.
0a082-0	Antenna	ERROR	Ele DDM communication	Communication error between PCM and elevation DDM. Check cable.
0a083-0	Antenna	ERROR	ISM communication	Communication error between PCM and ISM. Check cable.
0a084-0	Antenna	ERROR	PMM communication	Communication error between PCM and PMM. Check cable.
0a085-0	Antenna	WARNING	Azi DDM warning	The azimuth motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.
0a086-0	Antenna	WARNING	Xel DDM warning	The cross-elevation motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.
0a087-0	Antenna	WARNING	Ele DDM warning	The elevation motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.

Table E-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0a088-0	Antenna	WARNING	PMM warning	The polarisation motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.
0a089-0	Antenna	WARNING	Azi cal. limits	Azimuth axis calibration result check limits exceeded. Pointing performance may be degraded.
0a090-0	Antenna	WARNING	Xel cal. limits	Cross-elevation axis calibration result check limits exceeded. Pointing performance may be degraded.
0a091-0	Antenna	WARNING	Ele cal. limits	Elevation axis calibration result check limits exceeded. Pointing performance may be degraded.
0a092-0	Antenna	WARNING	Pol cal. limits	Polarisation axis calibration result check limits exceeded. Pointing performance may be degraded.
0a093-0	Antenna	WARNING	ISM warning	The ISM has temporarily observed an unusual situation with regards to temperature or voltage. No user interaction required. If repeated after cooldown and reboot, the ISM or cables around it may be defective.

Table E-1: ADU event messages (Continued)

E.3 List of ACU events

Error code (ID)	ACU PCB	Severity	Description	Explanation
08100-0	ADM	ERROR	PSM low voltage (22 V)	The ADM measures a different ADU voltage than expected. If the problem is not solved by a restart, and the PSM is not reporting any errors, the ADM is probably defect.
08101-0	ADM	ERROR	PSM high voltage (48 V)	The ADM measures a different ADU voltage than expected. Check for short circuit of the antenna coax connector. If the problem is not solved by a restart, and the PSM is not reporting any errors, the ADM is probably defective.
08102-0	ADM	ERROR	PSM 5 V power	Internal voltage supply error of the ADM.
08103-0	ADM	ERROR	PSM hot swap	The ACU is not able to supply the correct voltage to the antenna. Check for short circuits in coax cable and the antenna
08104-0	ADM	ERROR	ADU communication	The ACU cannot communicate with the antenna. Check cable and antenna.
08107-0	ADM	ERROR	ADM FPGA load	The ADM FPGA cannot be initialised and loaded
08108-0	ADM	ERROR	TX Power Detector calibration	The Tx power detector calibration is not valid.
08109-0	ADM	ERROR	ADU XIM data	There is a mismatch with the antenna configuration data. Either the PCM or the VIM in the antenna are malfunctioning or one of them has been replaced. In the latter case, please select which is the original device in the web MMI and restart the system.

Table E-2: ACU event messages

Error code (ID)	ACU PCB	Severity	Description	Explanation
0810a-0	ADM	ERROR	ADM production data	Production data has been corrupted
09000-0	KDM	ERROR	KDM 3V3 supply	Internal 3V3 voltage supply error in the KDM
09001-0	KDM	ERROR	KDM 12V supply	Internal 12V voltage supply error in the KDM
09002-0	KDM	ERROR	KDM display	Display hardware error in the KDM
0b000-0	PSM	ERROR	PSM production data	Missing or invalid production data in the PSM. It should be replaced.
0b001-0	PSM	ERROR	NMEA 2000 identifier	Missing or invalid production data in the PSM. It should be replaced.
08060-0	ADM	WARNING	ADU modem	ACU/ADU communication error detected (framing and parity). If the situation is persistent, check if cable specifications comply (length and attenuation).
08061-0	ADM	WARNING	VMU linux shell password	The specified password (root) for the VSAT modem is not accepted by the modem
08062-0	ADM	WARNING	VMU debug shell password	The specified password (user) for the VSAT modem is not accepted by the modem
08063-0	ADM	ERROR	ADU alive	The ACU has lost connection with the antenna
08064-0	ADM	ERROR	ADM PLL lock	The intermediate frequency PLL is not in lock. Check the 10 MHz reference signal
08065-0	ADM	WARNING	GNSS data	Missing GPS data (fix)
08066-0	ADM	WARNING	Heading data	Missing heading information. Check cable and heading provider device.

Table E-2: ACU event messages (Continued)

Error code (ID)	ACU PCB	Severity	Description	Explanation
08067-0	ADM	ERROR	PCB temperature	ADM temperature too high. The ACU is not equipped with a fan, so make sure environmental specifications comply
08068-0	ADM	ERROR	PSM power	The PSM fails to provide the requested supply voltage
08069-0	ADM	WARNING	Blocking Zone	The antenna has entered a blocking zone
0806a-0	ADM	WARNING	VMU connection	The ACU has lost connection with the VSAT modem
0806b-0	ADM	WARNING	ROSS connection	The ACU has lost connection with the ROSS device
0806c-0	ADM	ERROR	VMU frequency setup	There is a mismatch in the frequency setup. Probably the VSAT modem is not configured correctly to match the requirements of the ACU and antenna. A common mismatch is the absence of Rx or Tx LO parameter in the VSAT modem.
0806d-0	ADM	ERROR	ADU power	The ADU supply voltage is outside the allowed limits. This could happen if the PSM fails to provide the requested supply voltage or if the voltage difference across the hot swap is unacceptable high.
0806e-0	ADM	ERROR	VMU RX 10 MHz reference	The VMU 10 MHz reference signal is not present. Make sure VMU Rx cable is connected and that the VMU is configured to output the RX 10 MHz reference signal.

Table E-2: ACU event messages (Continued)

Error code (ID)	ACU PCB	Severity	Description	Explanation
0806f-0	ADM	ERROR	ROSS synchronization	The ACU has become out of sync with the ROSS device, most likely because the ACU has been replaced, or the ROSS satellite profile is new. A manual (forced) handoff sequence must be initiated from the ROSS, refer to the ROSS manual for the procedure.
0b060-0	PSM	WARNING	NMEA 0183 parse error	Parse errors detected on the NMEA 0183 interface. Check NMEA 0183 cable, signal levels etc.

Table E-2: ACU event messages (Continued)

A

ABS	Term used for service and support
ACU	Antenna Control Unit
ADM	Term for an ACU module
AMB	Term used for service and support

B

BUC	Block Up Converter - The BUC can be thought of the “transmitter”, and its actions are effectively the direct opposite to the LNB. The BUC consists of the Up Converter and HPA.

C

CE	Conformitée Européenne. This term signifies that a CE certified product conforms to European health, environmental, and safety regulations. In short, it makes the product legal to be sold in the European Union.
CM	Continuous Monitoring

D

DDM	DC-Motor Driven Module
DHCP	Dynamic Host Configuration Protocol. A protocol for assigning dynamic IP addresses to devices on a network. With dynamic addressing, a device can have a different IP address every time it connects to the network.
DVB	Digital Video Broadcasting, a set of standards relating to digital television.

E

EIRP	Effective Isotropically-Radiated Power. The amount of power that would have to be emitted by an isotropic antenna (that evenly distributes power in all directions) to produce the peak power density observed in the direction of maximum antenna gain.
ESD	ElectroStatic Discharge

ETSI	European Telecommunication Standard Institute

F

FPGA	Field Programmable Gate Array

G

GNSS	Global Navigation Satellite System
GPL	General Public License
GPS	Global Positioning System. A system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver.

I

IEC	International Electrotechnical Commission. The international standards and conformity assessment body for all fields of electrotechnology.
ISM	Inertial Sensor Module

K

KDM	Term for an ACU module

L

LAN	Local Area Network
LEN	Load Equivalent Number
LGPL	Lesser General Public License
LNB	Low Noise Block. A device used to amplify or boost the weak received signal without amplifying the noise signals (hence the “low noise” part of LNB) and to convert the high frequencies of the signal into lower frequencies, a process called down converting, for conveyance to the indoor equipment (demodulator) for processing.

N

NID	Network IDentification
NMEA	National Marine Electronics Association (standard). A combined electrical and data specification for communication between marine electronic devices such as echo sounder, sonars, anemometer (wind speed and direction), gyrocompass, autopilot, GPS receivers and many other types of instruments. It has been defined by, and is controlled by, the U.S.-based National Marine Electronics Association.

O

OMT	Ortho Mode Transducer
openAMIP	Open Antenna-Modem Interface Protocol

P

PAST	Person Activated Self Test
PCM	Pedestal Control Module
PMM	Polarisation Motor Module
POST	Power On Self Test. A system test that is activated each time the system is powered on.
PSM	Term for an ACU module

R

RF	Radio Frequency. Electromagnetic wave frequencies between about 3 kilohertz and about 300 gigahertz including the frequencies used for communications signals (radio, television, cell-phone and satellite transmissions) or radar signals.
RFI	Radio Frequency Interference. A non-desired radio signal which creates noise or dropouts in the wireless system or noise in a sound system.
ROSS	Roaming Oceanic Satellite Server
RSSI	Received Signal Strength Indicator

V

VIM	VSAT Interface Module

VMU	VSAT Modem Unit
VSAT	Very Small Aperture Terminal, a two-way satellite ground station or a stabilized maritime VSAT antenna with a dish antenna that is smaller than 3 metres.

W

WAN	Wide Area Network

X

XIM	Term used for service and support

Z

ZRM	Zero Reference Module

A

B

C

D

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N

O

P

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X

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